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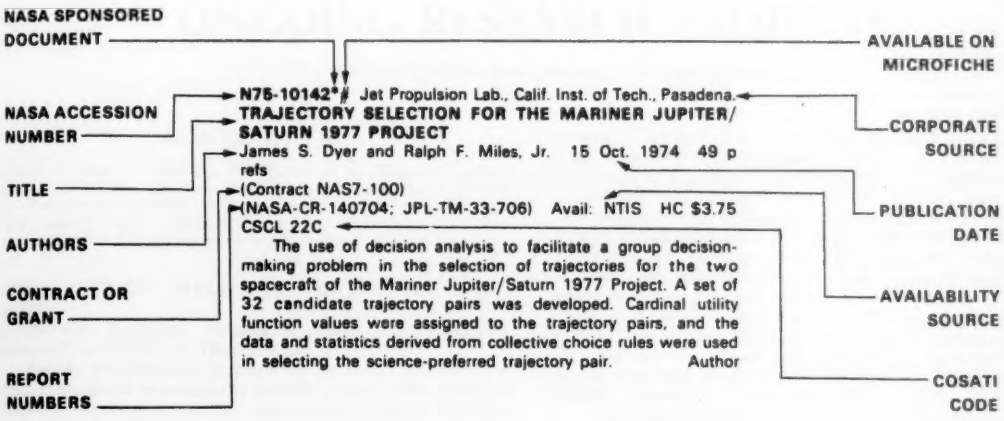
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N75-10142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRAJECTORY SELECTION FOR THE MARINER JUPITER/ SATURN 1977 PROJECT
CORPORATE SOURCE
TITLE
James S. Dyer and Ralph F. Miles, Jr. 15 Oct. 1974 49 p refs
AUTHORS
(Contract NAS7-100)
PUBLICATION DATE
CONTRACT OR GRANT
(NASA-CR-140704; JPL-TM-33-706) Avail: NTIS HC $3.75
AVAILABILITY SOURCE
CSCL 22C
REPORT NUMBERS
The use of decision analysis to facilitate a group decision-making problem in the selection of trajectories for the two spacecraft of the Mariner Jupiter/Saturn 1977 Project. A set of 32 candidate trajectory pairs was developed. Cardinal utility function values were assigned to the trajectory pairs, and the data and statistics derived from collective choice rules were used in selecting the science-preferred trajectory pair. Author
COSATI CODE

ON-GOING RESEARCH PROJECTS

This is a listing of research projects—not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, UPDATE PREDICTIVE VORTEX TRANSPORT MODEL
UNKNOWN, Lockheed Missiles & Space Co., *Huntsville, Alabama* 35807 (058315 (TRAIS NO.))

Specify and incorporate empirical or theoretical improvements in the predictive model to provide a quantitative means for including: initial conditions for wake descent such as allowance for flap effects, effect of engine exhaust entrainment during the vortex rollup process on the wake descent, vortex tilting in ground effect, vortex lifetime models, and a decrease in vortex strengths as a function of vortex age. The impact of each of the model updates shall be demonstrated by comparing predicted tracks with previously measured tracks. Each of the hydrodynamical and meteorological effects in the existing predictive model, as well as the updates, shall be parameterized by a multiplicative coefficient.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0002, EFFECTS OF HIGH-ALTITUDE GEOPHYSICAL EVENTS ON VHF AERONAUTICAL NAVIGATION AIDS
UNKNOWN, Univ. of Alaska, Graduate School, *College, Alaska* 99735 (058109 (TRAIS NO.))

Conduct an investigation of solar geophysical event effects on VHF navigation systems in and near the auroral zone. Continuously monitor VHF omnidirectional Radio Ranges (VOR) in both the Juneau and Fairbanks, Alaska, areas simultaneously for a period of six (6) months to a year as necessary to establish both the geomagnetic disturbance environment description and the impact on the VOR services which may normally be expected during the various seasons. Simultaneous radio disturbance data from other spectrum bands (HF, L-band, 2800 and 8800 GHz, other VHF, for example) in addition to magnetic, auroral, etc., descriptor data at various locations shall be obtained and correlated with the VOR band data for time and frequency relationships.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0003, ILS GLIDE SLOPE AND LOCALIZER STANDARDS
UNKNOWN, Systems Technology Assoc. Inc., *Hawthorne, California* 90250 (055924 (TRAIS NO.))

Standards shall be developed from the analysis of experimental data from simulated flight tests and, if available, actual flight tests. No flight tests are required. The effort shall be performed to examine the glide slope standard and shall emphasize heavy carrier aircraft operation. Light carrier and light business aircraft shall be included also.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0004, LORAN-C CYCLE MATCHING EVALUATION IN THE NORTH PACIFIC AREA
UNKNOWN, Continental Air Lines Inc., *Los Angeles, California* 90009 (058373 (TRAIS NO.))

Determine the adequacy of cycle matching Loran-C as a possible replacment for Loran-A in oceanic areas where useable Loran-C signal coverage exists. Effort includes: A. Evaluate the feasibility of using the Loran-C cycle matching technique as a replacement for Loran-A in terms of civil airline navigation standards of reliability and accuracy. B. Determine the comparative inflight performance characteristics of the following, representative Loran-C cycle matching receiver: 1. Teledyne Airborne Model TDL-302. Performance characteristics to be measured include: 1) reliability, 2) ease of operations, and 3) accuracy.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0005, FEASIBILITY OF POTENTIAL LASER APPLICATIONS
UNKNOWN, Stanford Research Institute, *Menlo Park, California* 94025 (055940 (TRAIS NO.))

Identify and where clearly necessary investigate two aspects of the feasibility of potential laser applications to approach and landing requirements in low visibility conditions. Specifically, the safety hazards and the actual effect which fog water droplets have on laser performance need to be documented through both analytical and empirical data which is directly correlated to the approach and landing environment.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0006, SENSITIVITY ANALYSIS OF OPERATIONS OF A 30 PASSENGER AIRCRAFT IN LOW DENSITY UNPRODUCTIVE MARKETS
UNKNOWN, U.S. Natl. Aero. & Space Adm., Ames Research Center, *Moffett Field, California* 94035 (058432 (TRAIS NO.))

The objective is to determine what factors of the operation will produce additional opportunities to improve the profitability of such operations.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0007, VLF MONITOR REQUIREMENT STUDY
UNKNOWN, U.S. Navy, Electronics Laboratory Center, *San Diego, California* 92152 (058111 (TRAIS NO.))

Determine the VLF signal monitor requirements of civil air navigation in the domestic and oceanic areas. Included in this determination will be all OMEGA and VLF communication signals that can be used for navigation. Design a VLF signal monitor system that will meet all civil air navigation requirements determined in Task A. The monitor system design shall include all necessary receivers, necessary inputs from external sources, and necessary outputs to serve as a complete VLF monitor system. Operational utility rather than signal data collection must be the primary consideration in the design of the signal monitor system.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0008, STANDARDS FOR SYSTEM PERFORMANCE PARAMETERS

G.R. SUGAR, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Boulder, Colorado* 80302 (2760165)

To educate the Electromagnetics Division technical staff in the field of digital communications; to identify the critical parameters of modern data communications systems; to develop and assess measurement techniques for using flux from radio stars for evaluating G/T ratio as figure of merit for performance of satellite ground stations; to establish standards of performance for instrument landing systems (ILS) and very high frequency omnirange systems (VOR), in support of FAA and Army in their navigational programs with necessary standards and measurement techniques.

1. Objective: To establish and disseminate measurement methods and standards for use in characterizing key performance parameters of operating electronic systems.

Motivation: The increasing complexity, sophistication, and density of use of electronic systems has reached a point such that precision measurement of key system performance parameters is essential if such systems are to be designed, manufactured, and used efficiently, and handled in commerce equitably. This project encompasses a variety of tasks being undertaken by the NBS Electromagnetics Division to respond to specific urgent needs in this area.

The use of telephone lines for data communication is growing rapidly. Performance measures and standards are needed for all the reasons cited above, and especially to foster economical use of existing lines, and to promote equity in trade between users and vendors of data communication equipment and services.

The Army is desperately trying to increase the operational efficiency of their satellite communication systems to transfer a greater degree of the extensive worldwide communication traffic to these systems and relieve the terrestrial lines. At present the satellite systems carry less than 1% of the traffic; their use must be increased to 25% by 1980. Development of instrumentation and measurement techniques to simplify evaluation of the figure-of-merit of satellite communication ground stations will provide the Army a measure of performance of a vital component (ground station) of the total system and so improve the efficiency of the system.

Present measurement techniques for modulation indices and phase angle (the critical system operating parameters) do not provide the accuracy and precision required for present and projected Instrument Landing Systems (ILS) and VHF Omnidirection.

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

1.0009, PROBABALISTIC INTERFERENCE PREDICTION MODEL - AIR/GROUND COMMUNICATIONS

UNKNOWN, U.S. Dept. of Commerce, Inst. For Telecomm. Science, *Boulder, Colorado* 80302 (058102 (TRAIS NO.))

Develop a computer subroutine that will give probability of interference estimates for non-standard or tailored service volumes. Obtain the theoretical probability of interference in a multi-sector environment and investigate a few practical examples to determine the effect of considering the additional interference sources.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0010, OBJECTIVE MEASUREMENT OF VOICE CHANNEL SERVICE GRADE BY TIME DOMAIN TECHNIQUE

UNKNOWN, U.S. Dept. of Commerce, Inst. For Telecomm. Science, *Boulder, Colorado* 80302 (058103 (TRAIS NO.))

Sample the voice signal, compute the corresponding coefficients which fit a prescribed set of functions to the voice signal, and then, using these coefficients, reconstruct the voice signal. Because of the high quality of reconstructed signals obtained it is evident that the coefficients contain the necessary information. This approach is to compare these coefficients computed before and after a signal is propagated to obtain a measure of the channel quality.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0011, FREQUENCY ASSIGNMENTS FOR CO-LOCATED ATC COMMUNICATION SYSTEMS

UNKNOWN, U.S. Dept. of Commerce, Inst. For Telecomm. Science, *Boulder, Colorado* 80302 (058107 (TRAIS NO.))

Task A - Theoretical prediction and Laboratory measurement - Requires bench tests and the use of available prediction techniques. This will establish a general cross modulation criteria which can be used to determine the spectral spatial separation required for antennas within line of sight. Task B - Test Method - Measurements at actual field locations will be made to validate the cross modulation criteria developed under Task A and to develop an intermodulation criteria.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0012, MULTIPATH PROPAGATION ON MICROWAVE LINKS

UNKNOWN, U.S. Dept. of Commerce, Inst. For Telecomm. Science, *Boulder, Colorado* 80302 (058112 (TRAIS NO.))

Gather data on the Boone-Fowler link to determine the effects of antenna orientation on the severity and duration of multipath degradation. Change antenna location and orientation to determine angle of signal arrival under various fade conditions. Investigate the effects of antenna elevation angle on signal strength under severe fade conditions to a degree which does not degrade the signal under normal conditions sufficiently to alter circuit performance. Generally, investigate critical adjustment features which would allow the 'fade margin' engineered into the present equipment to be adequate as opposed to more exotic solutions such as diversity. Develop the analytical procedures for ready application to other RML locations where multipath fades are being experienced.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0013, SCINTILLATION AND 'SEA STATE' MULTIPATH MODEL FOR AERONAUTICAL SPECTRUM PLANNING

UNKNOWN, U.S. Dept. of Commerce, Inst. For Telecomm. Science, *Boulder, Colorado* 80302 (058113 (TRAIS NO.))

Develop the mathematical approach for combining scintillation, sea condition, and atmospheric multipath phenomena with aircraft antenna patterns, flight altitudes and speeds (Doppler). Program this model accordingly to work in anticipated airborne communication and navigation environments and applications over the 100 MHz to 4 GHz range. Scintillation magnitudes for the geomagnetic equatorial and high altitude are to be treated. Curves of scintillation, sea states, and atmospheric effects shall be displayed as they act individually and in various simultaneous combinations to influence likely aeronautical operational situations. These should include effects as a function of frequency over a range of model capability in the aeronautical bands.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0014, MODERNIZATION AND UPGRADING OF AN FAA RADAR MICROWAVE LINK

UNKNOWN, U.S. Dept. of Commerce, Inst. For Telecomm. Science, *Boulder, Colorado* 80302 (058191 (TRAIS NO.))

Task I. ITS shall select, procure, test, install and evaluate commercially available state-of-the-art devices which can be used in an FAA retrofit program to improve the overall performance of in-service radar microwave link systems. Task II. ITS shall determine the technical feasibility and if so indicated, conduct a market survey to determine if off-the-shelf or readily modifiable remote-control and voice-service channel equipment is available for installation in existing RML terminals and repeaters under constraints imposed by usable baseband spectrum and available rack space. Task III. Field Installation and Evaluation of Modified System.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0015, STUDY OF AIRPORT/AIRWAY CONGESTION DELAYS AND THEIR RELATION TO TRAFFIC ACTIVITY LEVELS
UNKNOWN, Applied Urbanetics Inc., *Washington, District of Columbia* 20036 (058017 (TRAIS NO.))

As part of the overall program of the FAA Quiet Short-Haul Air Transportation System (QSATS) Office it is necessary to identify the need and direction for improvements to be made to the Nation's short- haul air transportation system. It is felt that potential areas for improvements may be those which are presently experiencing (or can be expected to experience during the 1976-1985 decade) increases in such system constraints as (1) airport ground times and (2) enroute airborne delays.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0016, DETERMINATION OF FLIGHT PROFILES FOR A MICROWAVE LANDING SYSTEM ENVIRONMENT
UNKNOWN, U.S. Air Force, *Washington, District of Columbia* 20330 (055892 (TRAIS NO.))

The overall objectives of this task are to: (1) determine what approach profiles are feasible in the MLS environment with various levels of sophistication of aircraft instrumentation; and (2) to establish a baseline for determining the aircraft instrumentation required to fully utilize the segmented/curved approach path capabilities of the MLS. The results of these investigations will have wide applicability to potential users of the MLS including General Aviation, Commercial Air Transport, and the various military services. The investigations shall consider operations in actual or simulated low visibility conditions and shall include analysis efforts, simulation efforts and data/procedures validation by flight testing.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0017, NATIONAL MICROWAVE LANDING SYSTEM (MLS) DEVELOPMENT PROGRAM
UNKNOWN, U.S. Navy, *Washington, District of Columbia* 20001 (055891 (TRAIS NO.))

Tasks include: (1) Employ an available MLS simulator to determine the impact of selected critical system parameters on the automatic control of aircraft. (2) Study each contractor's technique to identify potential problems of employing each system in an aircraft carrier environment with emphasis on antenna size, location, and weight. (3) Develop through analysis and flight evaluation, the detail performance requirements and performance criteria applicable to V/STOL operations. (4) Examine existing and proposed antenna designs which utilize low inertia or lightweight concepts and have potential application to the proposed MLS configurations.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0018, AERODYNAMIC STUDY FOR ENERGY CONSERVATION
G.M. PALMER, Purdue University, School of Aero. Astr. Eng. Sci, *Lafayette, Indiana* 47907 (058406 (TRAIS NO.))

Objective is to experimentally validate the reduction in aerodynamic drag possible through add-on devices and/or minor design changes to existing buses with the goal of reducing fuel consumption. Scale models will be constructed and tested in a wind tunnel. The impact of the resulting changes on drag, lift, side force, yawing moment, pitching moment and rolling moment will be documented. Road tests will be performed to determine both the reduction in the drag coefficient and fuel consumption.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0019, FUEL TANKS FOR PIPER NAVAJO AIRCRAFT
UNKNOWN, Uniroyal Incorporated, *Mishawaka, Indiana* 46544 (058394 (TRAIS NO.))

The objective is the fabrication, testing and installation of candidate crashworthy fuel cells for a typical general aviation aircraft.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0020, MICROWAVE LANDING SYSTEM, BALTIMORE, MD.
UNKNOWN, Bendix Corporation, *Baltimore, Maryland* 21204 (025172 (TRAIS NO.))

This project is a concurrent series of supporting government programs, to be undertaken by DOT, DOD, NASA, which will include validation efforts independent of the industry program, investigations of sub-system concepts and techniques, performance of flight test and system evaluation efforts, and application of the microwave guidance system to the requirements of the individual users. Special emphasis is placed on the need for expeditious development of a MLS basic design that will utilize a standard signal structure and feature highly flexible modular building-block concepts that will facilitate its being approximately configured to meet the complex requirements for full-scale all-weather automatic landings.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0021, REVIEW OF FAA PROGRAMS AND PREPARATION OF SUPPLEMENT TO OVERVIEW DOCUMENT
UNKNOWN, Industrial Tech. Assoc. Inc., *Bethesda, Maryland* 20014 (058328 (TRAIS NO.))

In preparation of the supplement to 'Overview of the FAA Engineering and Development Programs with Highlights of Fiscal Year 1974-1974,' 1) Determine and describe the principal highlights of the year for each E&D program; 2) Determine the progress on the Upgraded Third Generation Air Traffic Control System and provide a summary of that progress with a paragraph on each feature of the system; 3) Make recommendations to assure proper information exchange between system developers and system users, and assure accurate, clear communications relevant to all E&D information have been obtained; and 4) Prepare and furnish the required printed copies of the final document.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0022, CONDUCT TESTS AND EVALUATION OF TWO ELECTRONICALLY MODULATED TACAN ANTENNAS
R.V. WILSON, U.S. Navy, Electronic Test & Eval. Facil., *Patuxent River, Maryland* 20670 (055941 (TRAIS NO.))

Specify minimal tests and time required to determine the feasibility of sector beaming a cylindrical array electronically scanned TACAN antenna for use in data broadcasting. The feasibility study shall determine the beam characteristics that can be achieved with the existing U.S. Air Force's engineering model cylindrical array TACAN antennas. If the characteristics are not desirable for data broadcasting, the study shall continue to determine either the modifications to the antennas or new design features which would provide the required beam characteristics.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0023, RESEARCH ON INDEPENDENT OPERATIONS ON CLOSELY SPACED PARALLEL RUNWAYS USING AN AIRBORNE TRAFFIC SITUATION DISPLAY
M. ATHANS, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (058239 (TRAIS NO.))

Performance measures shall include, but not be limited to, miss distance, incidence of false alarms, pilot acceptance, and controller acceptance. System performance shall be measured for parallel runway spacings of 4300, 3500, 3000, 2500 and 1500 feet. Performance shall be evaluated under a worst-case set of initial conditions shall also be evaluated with the most-likely set of initial conditions. Recommendations shall be made for further

research and development activities needed to specify the operational requirements for use of an Airborne Traffic Situation Display.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0024, RESEARCH ON UNSTEADY, NONLINEAR TRANSONIC FLOW
W.L. HARRIS, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 1219; 505-02-21)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0025, AEROSAT WIDEBAND TEST PLANNING
UNKNOWN, C N R Incorporated, *Newton Upper Falls, Massachusetts* 02164 (058317 (TRAIS NO.))

Preparation of an AEROSAT wideband channel test plan document. This document will consist of original contributions by the contractor, including already completed Advanced Air Traffic Mangement Systems (AATMS) technology base experiment planning, integrated with work presently being completed by the U.S. Department of Transportation's Federal Aviation Administration on the Discrete Address Beacon System (ASTRO-DABS) concept specific test activities. The contractor will supplement these activities by defining an alternative to the ASTRO-DABS concept, identifying concept specific test activities and integrating these into the test plan document.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0026, OPTIMAL TRACKING DESIGN FOR TERMINAL TRACKING WITH INTERMITTENT POSITIVE CONTROL (IPC)
UNKNOWN, Arcon Corporation, *Wakefield, Massachusetts* 48226 (058110 (TRAIS NO.))

Tasks are: a.) Obtain accurate information on data quality DABS, ATCRBS, combined radar/beacon. b.) Develop methods of evaluating tracker performance. c.) Define tracker requirements for IPC. Establish the relationship between tracker performance and IPC performance. Analyze the effect of tracker errors on the performance of the IPC function. d.) Evaluate the performance of the basic ARTS III tracker with threshold detection and turn heading correction currently used by the FAA for IPC experimental work. e.) Validate and establish the performance of an optimized tracker for IPC. f.) Evaluate the impact of IPC tracker optimization on the ARTS III computer data association task.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0027, GENERAL AVIATION ENGINE EMISSION TESTING AND RESEARCH ON REDUCING EMISSIONS LEVELS
J.A. NICHOLLS, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (DOT-NAOO-4-16 (FAA))

Description: This research, which is being sponsored by the Federal Aviation Administration, involves the measurement of the emission characteristics of an aircraft engine over a range of operating conditions. The effects of an aircraft engine over a range of operating conditions. The effects of various engine modifications upon the emission of pollutants will be studied. An engine test stand with a dynamometer is being used to operate the engine under various controlled conditions. A Scott Dilute Exhaust Emission Measurement System is being used to measure the amount of CO, CO(2), NO, NO(x), O(2), and unburned hydrocarbon in the engine exhaust.

Addenda: Estimated calendar year funding reported as 1974 $123,000, 1975 $125,000.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0028, STRUCTURAL PAVEMENT DESIGN FOR LIGHT AIRCRAFT
UNKNOWN, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (058313 (TRAIS NO.))

Existing FAA design criteria for light aircraft will be evaluated and new criteria developed if required. The advisability of separate criteria for aircraft up to 12,500 lbs. and aircraft between 12,500 lbs. and 30,000 lbs. will be investigated. The study should recognize the impact of local material, climate, maintenance and the relationship between cost and value. The practices and recommendations of other government agencies and industry shall be considered.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0029, ELECTRICAL GROUND IMPEDANCE MEASUREMENTS IN ALASKAN PERMAFROST REGIONS
UNKNOWN, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (055908 (TRAIS NO.))

Measure the surface impedance of two (2) permafrost sites near Fairbanks, Alaska, in the frequency range from 20 KHz to 500 KHz. The ground conductivity will be measured from the wave tilt of vertically polarized fields over this frequency range. These surface measurements are to be under both summer and winter conditions at a time ideal for correlation with flight data to show the following: (a) The effect of seasonal thawing on the surface impedance of permafrost. (b) The variation in surface impedance with frequency for significant depths.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0030, GROOVE SHAPES AND PATTERNS FOR AIRPORT RUNWAYS
W.A. HIERING, U.S. Navy, Air Test Facility, *Lakehurst, New Jersey* 08733 (055907 (TRAIS NO.))

Conduct a test and evaluation program that will identify the most efficient groove shapes and patterns for various runway pavement materials that will provide optimum traction under all weather conditions, cause minimum damage and wear to aircraft tires, and can be easily and quickly installed at least costs. The tests and evaluations shall be performed in such a manner as to provide criteria for establishing grooving standards.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0031, TRANSPORTATION IN NEW YORK STATE
J.F. ZIMMERMAN, State Legislature, *Albany, New York* 12224 (110852 (HRB NO.))

All aspects of transportation in New York State are being studied. Included is the location of a New Jetport for the N.Y. City area and a second Jetport in the western part of the state, highway safety, new transportation technology, future of the New York State Barge Canal, Long Island and Penn Central Railroad Companies' Passenger Service and Waterfront Renewal, and recodification of the vehicle and traffic law. Reports issued: Wheels, Wings & Water, Transportation - a Blueprint for Mobility, N.Y.S. Joint Legislative Committee on Transportation, 1970. Mobility, N.Y.S. Joint Legislative Committee on Transportation, 1971. Crisis in Mass Transportation, 1971. Moving Today Toward Tomorrow, N.Y S. Joint Legislative Committee on Transportation, 1972. Transportation mobility in New York state N.Y.S. Joint Legislative Committee on Transportation, 1972.

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SUPPORTED BY New York State Government - Albany

1.0032, ENGINEERING SERVICES FOR ATCRBS ELECTRONIC SCAN ANTENNA
UNKNOWN, Hazeltine Corporation, *Greenlawn, New York* 11740 (058234 (TRAIS NO.))

Provide six (6) calender months of qualified senior engineering personnel servics on a continuous basis to perform routine maintenance and to participate in field tests and evaluation of the

antenna. The required services will include both field and design engineering.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0033, AIRBORNE OMEGA NAVIGATION RECEIVER, MODEL NAVOM III
UNKNOWN, Dynell Electronics Corporation, *Huntington, New York* 11746 (058108 (TRAIS NO.))

Technical assistance and engineering services to assist the Government, as may be required, including repair parts and materials, in the installation and maintenance of the equipment to insure proper system operation.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0034, TRI-STATE REGIONAL PLANNING COMMISSION CONTINUING, COMPREHENSIVE LAND USE AND TRANSPORTATION PLANNING PROGRAM
J.D. CARROLL, Tri State Transportation Comm., *New York, New York* (110768 (HRB NO.))

The continuing program considers factors affecting the development of the region, including existing and future population, land-use, transportation facilities and services, travel patterns, terminal and transfer facilities, traffic control features, financial resources and community values. In addition, it considers other aspects for public facilities including airports, general aviation requirements, hospital and medical facilities, open space and recreation, housing, welfare, water and sewer facilities, and urban planning assistance. In pursuing its continuing program, the Commission, as the official planning agency for this 8,000 square mile region of more than 18,500,000 people develops advanced techniques for data processing, traffic and land development simulation, and other similar tools to devise a feasible and operational plan for development. The Commission's planning efforts are aimed at coordinating matters of regional significance as well as supporting local, county, city and sub-regional planning efforts in the three states.

Document provided to S.S.I.E. by the H.R.I.S.

Addenda: This project is also supported by: Tri-State Transportation Commission; Department of Housing and Urban Development.

SUPPORTED BY U.S. Dept. of Transportation - F.H.A.

1.0035, STUDY OF AIRCRAFT DESIGN IMPROVEMENTS
UNKNOWN, U.S. Small Business Admin., *New York, New York* 10007 (058311 (TRAIS NO.))

Isolate the necessary design improvements for the Grumman American AA-1 and for any six (6) of the following eight (8) aircraft; i.e., the Cessna 210, 172, 150 and 182; the Piper PA-23, PA-28, PA-18, and the Taylorcraft B. Develop parameters to which numerical values can be ascribed, which can then be applied to statistical analyses; and shall identify parameters and features that can be shown to influence near- and post-stall aircraft behavior. Include those parameters and characteristics which produce desirable and undesirable conduct, as the behavior of stick and rudder pedal forces up to and through the stall.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0036, SOLID-STATE IF AMPLIFIER
UNKNOWN, Cardion Electronics Inc., *Woodbury, New York* 11797 (058250 (TRAIS NO.))

Design, development, fabrication and on site testing of an amplifier, fully solid-state, to replace the present 70-tube Distributed IF Amplifier-Detector on the Airport Surface detection Equipment (ASDE- 2) Radar.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0037, ESTABLISHMENT OF ILS TEST FACILITIES
UNKNOWN, Ohio University, Graduate School, *Athens, Ohio* 45701 (055882 (TRAIS NO.))

Establish an ILS test facility at a site featuring the most ideal electromagnetically environmental conditions required for precise evaluation of overall system standards and components as related to newly developed antenna arrays, monitor systems and flight inspection techniques. In addition, the Contractor shall provide operation of facility equipment, engineering analysis and flight inspection.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0038, COLLECTION OF GLIDE SLOPE DEEP SNOW DATA
UNKNOWN, Ohio University, Graduate School, *Athens, Ohio* 45701 (058097 (TRAIS NO.))

Throughout the winter, measure and record the following at weekly intervals and particularly after each 3-inch or greater snow fall. a. Glide slope angle over threshold with portable mast. b. Glide slope angle over the outer marker with aircraft and theodolite. c. Depth of snow. d. Temperature and density of snow. e. Monitor indications and alarms if any. Make recommendations with respect to the operation of FAA glide slope facilities under heavy snow conditions.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0039, A TACTUAL DISPLAY AID FOR PRIMARY FLIGHT TRAINING
R.D. GILSON, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (NAS 2-8954; 504-09-33)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0040, VHF INTERFERENCE CANCELLATION SYSTEM
UNKNOWN, Magnavox Company, *Philadelphia, Pennsylvania* (058324 (TRAIS NO.))

Requirements for a VHF Interference Cancellation System (ICS) designed to reduce the levels of interfering signals to VHF receivers from nearby or collocated transmitters. Requirements will provide flexibility in application through modular addition or expandable construction wherein combinations of up to four (4) each transmitters and receivers can be accommodated in a variety of problem situations characteristic of air traffic control (ATC) communications facilities.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0041, IN SITU VERSUS SAMPLING METHODS FOR MEASURING AIRCRAFT ENGINE EXHAUST EMISSIONS
UNKNOWN, U.S. Air Force, Arnold Engin. Dev. Center, *Tullahoma, Tennessee* 37389 (058120 (TRAIS NO.))

Identify and evaluate the discrepancies between the measured species composition of a sample of exhaust gas extracted through a sampling probe and transfer line, and the composition of the free stream gas before entering the sampling probe. The measurement program shall consist of obtaining simultaneous in situ and probe sample measurements of the species CO2, NO, NO2 and CO for a range of combustor conditions. The samples shall be obtained at the nozzle exist of a turbojet combustor simulator at two locations in the sample line between the probe and the readout instruments.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0042, JOINT-SERVICE NOISE EXPOSURE FORECAST SYSTEM TESTS
UNKNOWN, U.S. Navy, Facilities Engineering Command, *Alexandria, Virginia* 22332 (055865 (TRAIS NO.))

Provide two flyovers for each helicopter tested.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0043, FAA GROUND COMMUNICATION SYSTEM
UNKNOWN, Telcom Incorporated, *McLean, Virginia* 22101 (055889 (TRAIS NO.))

Tasks include (1) Perform an evaluation of the U.S. AFTN communications system. (2) Develop design specifications for a modernized Service B Communications System. (3) Develop equipment performance specifications for a modernized Service B/U.S. AFTN Communication System.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0044, DESIGN AND CERTIFICATION CRITERIA FOR SONIC BOOM NOISE
UNKNOWN, U.S. Small Business Admin., *Seattle, Washington* 98104 (058101 (TRAIS NO.))

Twelve families shall be studied in their homes to determine the effects of sonic boom intrusions on their daily living activities. Psychological, sociological and psychophysical measures will be obtained. Three ranges of levels shall be investigated at the rate of 2 per hour from 0700 to 2200 or 30 per day. Actual or simulated boom signals shall be obtained and described (rise time, overpressure, period) as free-field booms (outdoor booms). They will then be attenuated electronically to account for changes due to usual home structure. A minimum of four speakers shall be used to present the indoor booms and acoustical assessment of the booms shall be obtained at not less than six different positions in each home. Spectral analyses for all booms at six positions shall be obtained via Fourier Transforms.

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ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, MARITIME-SATELLITE ATS-6 DATA REDUCTION
UNKNOWN, Proteon Associates Inc., *Waltham, Massachusetts* 02154 (055923 (TRAIS NO.))

Task 1 - Review calibration procedures, check out procedures and the collected quick-look data. Task 2 - Define data reduction procedures for the digital data collected during Maritime-Satellite ATS-6 Tests. Task 3 - Design and analyze a surveillance technique suitable for use on Maritime-Satellite communication links.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, RACEMIZATION OF AMINO ACIDS IN MARINE SEDIMENTS
UNKNOWN, Calif. State Univ. & Colleges, Graduate School, *Hayward, California* 94541 (NCA 2-90601; 192-55-62)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0002, THERMAL STABILITY AND DEGRADATION OF FIRE-RESISTANT CANDIDATE POLYMERS FOR AIRCRAFT INTERIORS
J.A. NEPTUNE, Calif. State Univ. & Colleges, School of Natural Sci. & Math., *San Jose, California* 95192 (NSG 2093; 505-01-31)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0003, ANTI-REFLECTIVE COATING OF A PLASTIC DISPLAY FILTER
UNKNOWN, Optical Coating Lab. Inc., *Santa Rosa, California* 95403 (058193 (TRAIS NO.))

Apply a non-reflective coating to one side of Lexan Filters.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

3.0004, LASER-INDUCED PHOTOLUMINISCENCE STUDIES OF PRIMARY PHOTOCHEMICAL PRODUCTION PROCESSES OF COMETARY RADICALS
W.M. JACKSON, Howard University, Graduate School, *Washington, District of Columbia* 20001 (NSG 5071; 340-00-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0005, TURBULENT FLAME
T. KASHIWAGI, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (4915680)

Objective: a. To complete designing and fabricate the apparatus. b. To design and develop instrumentation techniques suitable for physical and chemical measurements. c. To develop photographic technique obtaining visual observation.

Approach: A two-dimensional shear configuration simulating the mixing of a fire plume with quiescent air is used to produce aerodynamic turbulence. Techniques of visual observation, physical-chemical measurements will be developed.

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

3.0006, SURFACE DEFORMATION AND ELASTICITY STUDIES
R.G. BILHAM, Columbia University, Graduate School, *New York, New York* 10027 (NSG 5072; 653-00-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0007, HARDNESS AND FRACTURE STRENGTH OF CEMENTED CARBIDES, CONTRIBUTION TO THE DESIGN OF TOOL MATERIALS
J. GURLAND, Brown University, Graduate School, *Providence, Rhode Island* 02912 (GH-42182)

The relation of the hardness and fracture toughness to the microstructural variables of cemented carbides will be studied in WC-Co alloys and TiC-Ni alloys. The experimental work on hardness will consist of 1) diamond pyramid hardness determination and microstructural characterization of specimens prepared in our laboratory or obtained from commercial sources, 2) determination of the degree of plastic deformation in the constituents of the aggregate during indentation by optical and electron microscopy, 3) determination of stress-strain curves in compression of selected specimens. The theoretical analysis will attempt to interpret the hardness data in terms of the uniaxial stress-strain behavior by consideration of the mechanics of hardness testing. It is expected that this work will result in a predictive relation between hardness and microstructural variables based on theory of plastic deformation of two-phase aggregates.

The fracture toughness will be evaluated by a double cantilever beam (DCB) test. The major effort will be devoted to preparation of DCB specimens, construction of loading fixtures, and preliminary correlation of DCB results with acoustic emission and electron fractography. The interpretation of results and theoretical analysis leading to elucidation of the mechanism of crack initiation and propagation will be completed in an additional contract period.

SUPPORTED BY U.S. Natl. Science Foundation

3.0008, EFFECT OF HZ AND IRRADIATING WAVELENGTH ON PHOTOCHEMICAL PRODUCTION
UNKNOWN, Univ. of Houston, Graduate School, *Houston, Texas* 77004 (NCA 2-95801; 970-24-01)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, NATURALLY OCCURRING VERY-LOW-FREQUENCY RADIO SIGNALS
R.R. HEACOCK, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (DES73-06534 A02)

The very-low-frequency data recording system at College will be continued in operation in the present mode at the White Sands radar site, 40 km north of College, Alaska, until summer 1975. The equipment will then be moved to the Chena Valley site, 40 km ENE of Fairbanks, and combined with the present system at Chena to form a 2-component system that will be operated at selected times simultaneously with the Chatanika backscatter radar. It is proposed that a third (z) component be added to the present 2-component lower-elf (5-500 Hz) system operating at the White Sands site on Poker Flat research Range.

Analysis of very-low-frequency data will be centered around wave- particle interactions and vlf wave-ulf wave interactions. We seek a complete picture of the relations between pulsating precipitation of particles into the ionosphere, correlated ulf waves (micropulsations), and amplitutude modulations of vlf emissions by ulf waves. In part, this work amounts to an experimental evaluation of the theory of Coroniti and Kennel (J. Geophys. Res., 75, 1970) and some related theories.

Analysis of lower-elf data will be concerned with wave polarization characteristics of the Whistler-like events (80-100 Hz) which enter the earth-ionosphere cavity with the exosphere and with polarization characteristics of Schumann noise signals trapped in the E-I cavity.

A theoretical model for type Pi 1 micropulsations will be completed and a theoretical investigation of the Whistler-like events will be undertaken.

SUPPORTED BY U.S. Natl. Science Foundation

4.0002, STUDY OF MULTIPLE JET ARRAY IMPINGEMENT HEAT TRANSFER CHARACTERISTICS
D.E. METZGER, Arizona State University, School of Engineering, *Tempe, Arizona* 85281 (NSG 3075; 505-04-22)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0003, FABRICATE AND TEST AIRBORNE ELECTRONIC VEHICLE IDENTIFICATION SYSTEM
UNKNOWN, Hoffman Electronics Corp., *El Monte, California* 91734 (048779 (HRB NO.))

The objective of this procurement is the field testing and preliminary operational evaluation of a prototype set forth below: Item 1 - Prepare and submit three (3) copies of a Master Program Schedule. Item 2 - Evaluate and report on results.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

4.0004, STUDY OF FLOW SEPARATION PHENOMENA
UNKNOWN, Stanford University, Graduate School, *Palo Alto, California* 94305 (NCA 2-45602; 505-17-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0005, ACOUSTIC DISTURBANCE GENERATED BY COMBUSTION NONUNIFORMITIES INTRODUCED INTO A TURBINE
F.E. MARBLE, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (058357 (TRAIS NO.))

Calculate the two-dimensional acoustic response of typical turbine blade-row configurations, consisting of from one to four blade rows, to temperature, vorticity, and acoustic nonuniformities produced in a combustion chamber. Utilizing the two-dimensional theory for an annular two blade-row turbine, determine the acoustic output at the turbine discharge corresponding to a turbulent combustion chamber input, represented by spectral distributions of entropy, vorticity, and acoustic disturbance. Estimate the far field disturbance resulting from these acoustic sources at the turbine discharge.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

4.0006, BEACON MEASUREMENTS
K. DAVIES, U.S. Dept. of Commerce, Environ. Research Laboratories, *Boulder, Colorado* 80302 (RDJ4 13 21)

Project objective: To carry out joint ATS-F beacon measurements.

Current year plan: 1. Equipment for Limon field site is supplied by Max-Planck. 2. SEL will supply field site space. 3. SEL will supply AC power at the site. 4. SEL will check data recording and equipment.

SUPPORTED BY Max Planck Society - Munchen

4.0007, WWVH BROADCASTS
C.L. TREMBATHE, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Boulder, Colorado* 80302 (2776124)

Objective: The purpose of this project is to disseminate frequency-time and other related information by HF radio broadcasts. This station supplements transmissions from WWV and is designed to extend coverage into the Pacific and Far East areas to meet the needs of military, industrial, navigation, scientific, and other civilian users.

Approach: This most widely used and essential service is made available continuously to industry, government, and the public through HF radio broadcasts transmitted from WWVH on 2.5, 5, 10, 15, and 20 MHz. Telephone time-of-day is also provided by dialing (808) 335-4363, Kekaha, Kauai, Hawaii.

Progress: Transmissions continued on all frequencies. Time code generators were modified for greater flexibility in our broadcast format. Antenna tower maintenance was started and will continue throughout next FY. The building was painted. The installation of the manual by-pass switch on the engine generator set was postponed in favor of higher priority commitments.

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

4.0008, EMISSION SPECTRUM SIMULATION
UNKNOWN, U.S. Dept. of Commerce, Inst. For Telecomm. Science, *Boulder, Colorado* 80302 (055946 (TRAIS NO.))

Develop a computer program capable of simulating the emission spectrum of typical interference sources covered in FCC Rules and Regulations Parts 15 and 18, and other devices operating in or near ATC bands such as dielectric heaters, diathermy, automobile ignition systems, R.F. stabilized arc welders, superregenerative receivers, garage door openers, field disturbance sensors, VHF ATC band receivers, and Doppler radar speed trap equipment. The computer program shall enable the operator to vary spectrum parameters such as frequency and amplitude of carrier and subcarriers, if used; modulation type, frequency, and index; pulse rise time, decay time, width, repetition rate; transmitter filter characteristics; and sideband and carrier suppression, to permit simulation of new emitters.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

4.0009, ANALYTICAL PROCEDURES FOR A PRIORI ASSESSMENT OF KEY CONTROL VARIABLES
G.J. MICHAEL, United Aircraft Corporation, *Hartford, Connecticut* 06118 (DF040250; F44620-75-C-0027)

In the design of complex Air Force systems with interactive controls, it is not always clear that the improved performance gained by controlling a particular control variable is justified when the additional cost and system complexity are considered. For example, when controlling the latest variable geometry turbine engines, it would appear reasonable that some of the available controls could be simply scheduled over the operational envelope, with no significant performance degradation from that obtained using full-state feedback. This conjecture would seem equally reasonable in the flight control synthesis of high performance aircraft, designed using CCV concepts. This research program will consider this problem, developing analytical procedures for assessing the relative importance of all the control variables so as to select for feedback control only those variables whose effect upon system performance is substantial. The assessment would be based upon a modal interpretation of multivariate system dynamics, and would allow the designer to separate the controls into those requiring only simple scheduling and those needing state feedback. In addition to the model approach a performance index quadratic would also be used to assess feedback control criticality for each control variable. These results would be extended to nonlinear systems, and then would be evaluated against numerical examples.

Supporting agency address information: AF Office of Scientific Research NM, 1400 Wilson Blvd, Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0010, MECHANICAL TEST METHODS
L. MORDFIN, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (2130141)

Objective: The primary objective is to develop test methods, techniques, instrumentation, and analytical procedures for use in determining important mechanical properties of materials and generalized structural configurations where standard methods, instruments, or specimens are not satisfactory due to environment, loading conditions or geometry. Current objectives are to: (a) develop test methods and finite element computer programs for use in studying structural joints formed by adhesive bonding used in combination with spot welding, bolting, or riveting; (b) develop creep testing machines based upon an NBS design to provide for a transfer of technology related to high load stress-rupture testing from NBS to NASA/Langley; (c) develop end fixtures and test methods to evaluate the mechanical properties or novel materials for use as helicopter slings; and (d) conduct a pilot study of test methods required to investigate the size effect on mechanical properties of polymer impregnated concrete.

Approach: Experimental and analytical procedures are utilized to develop methods for use in measuring important mechanical properties and behavior of materials and structures, to study problems of national concern. An example of this approach can be seen in the study of the crush characteristics of automotive components where both static and dynamic test procedures were used to evaluate factors which relate crushing of components at different loading rates.

Progress: (2130141). A study of the utilization of unique facilities was completed. The pilot study on the use of the 12,000,000 lbf testing machine to investigate the size effect on mechanical properties of polymer impregnated concrete was postponed due to reprogramming in the Mechanics Division. An internal report describing the finite element analysis of weld bonded joints is now in review. (2130448). The report to the Army on tests of weld bonded joints was delayed because the specimens from the sponsor were more than six months late. (2130446). The development of test methods to evaluate the crush characteristics of automotive components at different loading rates was completed and reported to DOT/NHTSA.

Addenda: This project is also supported by DOT, ARMY, NASA.

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

4.0011, FLIGHT TEST EVALUATION OF SCARE R217A RADAR
UNKNOWN, U.S. Navy, Air Systems Command, *Washington, District of Columbia* 20360 (056000 (TRAIS NO.))

Detection of moving targets, the production of high resolution ground map and to demonstrate detection sensitivity for the Navy as well as oil spills and the detection of small boats for the Coast Guard's pollution control and search and rescue missions.

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SUPPORTED BY U.S. Dept. of Transportation - Coast Guard

4.0012, GAS-FILM COOLING OF TURBINE VANE SURFACES
M.R. LECUYER, Purdue University, School of Mechanical Engin., *Lafayette, Indiana* 47907 (NSG 3071; 505-04-22)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0013, SHORT-RANGE, ALL-WEATHER, HIGH PRECISION NAVIGATION SYSTEM - LOCATION SYSTEM
J.B. OAKES, Johns Hopkins University, Applied Physics Laboratory, *Silver Spring, Maryland* 20910 (012070G(TRAIS NO.))

To initiate development of an all-weather navigation system which is capable of providing precise position location in narrow channels. This system would be used in areas where traffic density is not great enough to warrant a Harbor Advisory Radar system, but needed to prevent accidents and pollution due to vessel groundings.

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SUPPORTED BY U.S. Dept. of Transportation - Coast Guard

4.0014, REDUCTION OF ATCRBS ANTENNA PATTERN DATA
UNKNOWN, U.S. Small Business Admin., *Boston, Massachusetts* 02114 (055863 (TRAIS NO.))

Develop and exercise computer software for processing radiation pattern data related to several ATCRBS antennas. The output of the task shall be a computer-generated representation of an air traffic controller's display using a CDC6600 computer and a CALCOMP 770 plotter.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

4.0015, DEVELOPMENT OF TECHNIQUES FOR TURBOMACHINERY FLUTTER CLEARANCE
J.L. KERREBROCK, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 3079; 510-55-01)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0016, ENGINEERING SERVICES ON POWER AND PROPULSION SYSTEMS
A. KUSKO, Alexander Kusko Incorporated, *Needham Heights, Massachusetts* 02194 (107314 (HRB NO.))

The purpose of this project is to study the engineering services on power and propulsion problems in electric vehicles, railroad equipment, air-cushion vehicles and personal rapid transit (PRT) systems. /DOT/

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SUPPORTED BY U.S. Dept. of Transportation - N.H.T.S.A.

4.0017, INSTALLATION AND TESTS OF DOPPLER ACOUSTIC SENSOR
UNKNOWN, Avco Corporation, *Wilmington, Massachusetts* 01887 (055969 (TRAIS NO.))

Demonstrate the operation of the DAVSS and its ability to detect and track in real time the vortices generated by commercial jet aircraft during landing operations at JFK Airport. Tests shall be conducted with two (2) and four (4) sensor elements

operating in turn in the bistatic and monostatic modes previously described. The contractor shall examine the environmental data obtained at Wilmington, Logan and Kennedy to determine their effect on the capability of the engineered DAVSS to detect and track vortices reliably and with precision.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

4.0018, DAMPING TECHNIQUES FOR ALL MODES IN AN AUTOMATED CONTROL SYSTEM

G. MITCHELL, Mississippi St. University, Graduate School, *Mississippi State, Mississippi* 39762 (NAS 8-31568; 989-13-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0019, INVESTIGATION OF GROUND TRANSPORTATION VEHICLES SUPPORTED BY AERODYNAMIC FORCES

UNKNOWN, Princeton University, Off. of Res. & Project Admin., *Princeton, New Jersey* 08540 (045911 (HRB NO.))

The objective of this contract is to obtain information on the dynamic stability of high-speed ground transportation vehicles supported entirely by aerodynamic forces.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

4.0020, OBJECT SURFACE ANALYSIS AT OPTICAL FREQUENCIES USING THE COHERENT IMAGE FIELD

A. ERTEZA, Univ. of New Mexico, School of Engineering, *Albuquerque, New Mexico* 87106 (ENG75-01485)

This research concerns a new method for conducting remote studies of the scattering properties of an object surface, using the often bothersome speckling phenomenon in the coherent image of that object. Both theoretical and experimental efforts are proposed; to establish the usefulness and the limitations of the method. Initial emphasis will be directed towards an understanding of, and the development of, a deterministic theory for the speckling phenomenon. A rigorous experimental verification of the theory will be the next logical step of the effort. Analytical relationships emerging from such a theory will finally point towards the necessary set of measurements and the required procedures for the remote studies of the target surface properties.

SUPPORTED BY U.S. Natl. Science Foundation

4.0021, DESIGN, CONSTRUCT AND TEST TWO ADAPTIVE DELTA VOICE MODEM EQUIPMENTS

UNKNOWN, Bell Aerospace Company, *Buffalo, New York* 14240 (058319 (TRAIS NO.))

This voice modem equipment when retrofitted to existing DOT/TSC Advanced Quadrature Modulation/DPSK Modems, will provide an Adaptive Delta Voice Modulation (ADVM) technique for use in the ATS-6 Satellite L-Band Test Program.

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SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

4.0022, AERODYNAMIC INSTABILITIES ON ABLATED NOSE SHAPES

M.S. HOLDEN, Calspan Corporation, *Buffalo, New York* 14221 (DF040280; F44620-75-C-0019)

Weapons delivery and maintaining superiority in reconnaissance and surveillance requires the AF to obtain improved aerospace vehicles and subsystems. This will require that design for reentry and penetration be reduced to an accurate engineering procedure. This is not now possible, particularly with regards to problems involving the integrity of the nose tip of high performance reentry vehicles, especially with regards to heat loads. The object of this research is to develop an increased understanding of the phenomena underlying the development of flow instabilities on ablated nose shapes. It is believed that these instabilities are a crucial factor in the integrity of the nose cones of reentry vehicles. Emphasis in this study, centered around experiments to be conducted at Mach numbers from 6.5 to 13 and Reynolds numbers (based on body diameter) up to 80 million, would be placed on understanding the fluid mechanics of both symmetric and asymmetric instability modes. Measurements of both mean and fluctuating components of pressure, heat transfer and skin friction are to be made on typical ablated nose shapes. The effect of controlled roughness on transition, the characteristics of the transition region and the mechanics of the instabilities will be studied. The mean and fluctuating structure of the flow field will be examined by optical means.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd, Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0023, APPLICATIONS OF HIGH-POWER LASERS

J.C. ANGUS, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (NSG 3074; 506-25-9X)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0024, ROLLER BEARING GEOMETRY DESIGN

M. SAVAGE, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (NSG 3077; 505-04-41)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0025, SPECIAL FOREIGN CURRENCY AWARD - HEAT TRANSFER AND STABILITY OF WATER FILM EXPOSED TO HIGH VELOCITY WET STEAM FLOW

J. KRZYZANOWSKI, Inst. For Fluid Flow Machinery, *80 952 Gdansk, Poland* (OIP75-01317)

This proposal is concerned with the problem of flow of liquid on surfaces of stator blades in large steam turbines. Among specific objectives are the determination of the mechanism of film break-up into rivulets and dry-spot formation, as well as investigation of the stability of the film under realistic conditions involving surface irregularities, effects of wetting properties and near- and transonic flow of steam outside the film. Also the heat transfer from the film and rivulets under these conditions is to be investigated. The ultimate objective is to achieve predictable means of film removal by heating, thus reducing large drop formations which lead to severe erosion problems in turbines in excess of 600 MW. The problem is of considerable practical interest to both the USA and Poland since turbine sizes continue to grow and 2000 MW sizes are beginning to be discussed. Film flow, stability and break-up is of great interest in many other areas such as nuclear reactors, film evaporators, film-cooled gas turbine blades, etc.

The proposed work is an outgrowth of experimental work by Professor Moszynski and Professor Krzyzanowski which demonstrated the feasibility of film flow machines in Gdansk where also most of the analytical work on heat transfer would be performed. The remaining analytical work would be done at the University of Delaware.

SUPPORTED BY U.S. Natl. Science Foundation

4.0026, SYSTEM MAINTENANCE MONITOR CONSOLE (SMMC)

R. MILAGRANO, Electronic Laboratories Inc., *Houston, Texas* 77018 (025399 (TRAIS NO.))

Fabricate, test and deliver a System Maintenance Monitor Console (SMMC) to NAFEC, and within one month after delivery install and perform on-site system checkout and tests. Fabricate, test, and deliver SMMC consoles to 20 field sites and to the FAA Academy in Oklahoma City, Oklahoma.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

4.0027, STUDIES OF INTERNAL FLOWFIELDS OF HIGH THROAT-MACH-NUMBER QUIET ENGINE INLETS

A.K. JAKUBOWSKI, Virginia Polytechnic Institute, School of Engineering, *Blacksburg, Virginia* 24061 (NSG 3073; 505-03-12)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0028, AN ANALYTICAL AND/OR NUMERICAL STUDY OF THREE-DIMENSIONAL BOUNDARY LAYER FLOWS
G.L. GOGLIA, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1226; 505-06-11)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production And Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, MAPPING PHREATOPHYTE DENSITY AND DISTRIBUTION IN ARIZONA FROM AERIAL PHOTOGRAPHS AND ERTS IMAGERY
R.M. TURNER, U.S. Dept. of the Interior, Geological Survey, *Tucson, Arizona* 68001 (WR 00-116)

The time, quantity, and place of evapotranspiration (ET) are changed by man in his efforts to develop or control his environmental resources. Construction of storage reservoirs, diversion of streamflow, groundwater pumping, vegetation manipulation, and urbanization are examples of the changes man produces. These artificial changes, superimposed on the natural variability of the landscape, create an ever-increasing need for effective methods of estimating ET. Riparian or phreatic habitats in arid regions should provide the simplest conditions for developing these methods because water losses are high where they do occur and because these losses are mostly restricted to narrow, sharply defined zones.

To construct maps of riparian and phreatic vegetation for all of Arizona, to develop photointerpretive methods for identifying vegetation types and for estimating density, to estimate ET losses from Arizona's major drainage network.

NASA highflight photographs, ERTS-1 bulk imagery, and existing USGS aerial photographs will be used as the data base for compiling a map of phreatic and riparian vegetation for all of Arizona. Upon completion of map, estimates of ET will be made based upon the best available data from previous studies of ET.

Phreatophyte mapping is completed for approximately 40% of the area of Arizona. The base map is at a scale of 1:125,000. The mapping has been done with NASA photography at the same scale as the base map. Field checking has been done for only a small part of the total area mapped.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0002, MULTIBAND AERIAL REMOTE SENSING FOR MATERIALS IDENTIFICATION
M.L. MCCAULEY, State Div. of Highways, *Sacramento, California* 95814 (108927 (HRB NO.))

Aerial remote sensing data will be evaluated for use in identifying materials on the earth's surface. The data will include color, black and white, and infrared photography as well as multiband line scan imagery. Interpretations will be made by standard photointerpretation techniques and by computer analysis using both digital and analog techniques. Detailed geologic mapping will provide the basis for evaluating the various methods.

Document provided to S.S.I.E. by the H.R.I.S.

Addenda: This project is also supported by: California Department of Transportation Division of Highways.

SUPPORTED BY U.S. Dept. of Transportation - F.H.A.

5.0003, DATA ACQUISITION
C.E. HORNBACK, U.S. Dept. of Commerce, Environ. Research Laboratories, *Boulder, Colorado* 80302 (8DJ2 29 60)

Project objective: The Real-Time Data Services provides data collection and research facilities at Table Mountain, Colorado and Anchorage, Alaska, for monitoring satellite and ground base geophysical sensors. The data are used to support the Space Environmental Services of SEL and the AF AWS.

Current year plan: The present plan is to continue the facility operations and develop new satellite reception and data processing and display systems.

Progress report: A system was developed to receive the SMS/GOES A data.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0004, THEORETICAL STUDIES GROUP
J.R. WAIT, U.S. Dept. of Commerce, Environ. Research Laboratories, *Boulder, Colorado* 80302 (8DJ42507)

Project Objective: To support J. R. Wait's research for FY 76 in the area of electromagnetic scattering from complex targets whose dimensions are comparable with wavelength.

Current Year Plan: Upper atmosphere research, particularly with reference to scattering from hydrometers, hail particles and related targets in geophysical probing.

Progress Report: A general wave optical technique has been developed to handle these problems. Some new results have been obtained for the resonant backscatter from quasi-periodic structures such as the ocean.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0005, USE OF METEOROLOGICAL SATELLITE DATA IN THE TROPICS
T.H. VONDERHAAR, Colorado State University, School of Science, *Fort Collins, Colorado* 80521 (OCD71-00585 A04)

The objective of this work is to use satellite data to study the energetics of the tropical atmosphere. The work is subdivided into two areas. The first is the continued use of atmospheric state parameters, wind fields and cloud characteristics inferred from satellite data to study synoptic and mesoscale systems in the tropics. Since height of the inferred wind vectors is very important, work will be directed toward use of concurrent infrared (NIMBUS THIR) data to locate vertically the clouds tracked in ATS-3 imagery. Temperature profiles both from disturbed and undisturbed situations will be studied using satellite as well as ship and island rawin data. Studies will be made of 'in situ' thermodynamics and radar measurements, with satellite data to obtain the phenomenology of active cumulus regions. The second area of work will be to develop a program to deal with the satellite measured radiation budget and to obtain the most complete and accurate data set of the radiation budget that has ever been obtained over the tropics. The program is designed to measure the radiation budget before, during and after GATE. Measurements from 3 satellites (NIMBUS F, SMS-A and ITOS-D) will be used.

SUPPORTED BY U.S. Natl. Science Foundation

5.0006, MODELLING THE TERRESTRIAL HYDROLOGY OF THE GLOBAL ATMOSPHERE
P. BOCK, Univ. of Connecticut, School of Engineering, *Storrs, Connecticut* 06268 (NSG 5075)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0007, A POLAR NEPHELOMETER STUDY OF WATER SURFACES
W.C. CURTIS, Dist. of Columbia Teach. Coll., Undergraduate School, *Washington, District of Columbia* 20009 (NSG 6003; 340-00-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0008, STRUCTURE OF TURBULENCE
F.N. FRENKIEL, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (2130182)

Objective: To develop and devise measurement techniques incorporating analog and digital methods for the measurement of the statistical properties of turbulence, and to provide significantly new data which will extend our knowledge of turbulent processes.

Approach: The microstructure of turbulence will be investigated using hot-wire instrumentation and high-speed computing methods. Analog recordings of turbulent data are made on multi-channel magnetic tape for a turbulent field established in the NBS wind tunnel. The analog data is digitized & analyzed at NSRDC. Both isotropic and anisotropic turbulent fields will be studied. Special emphasis will be given to the small-scale turbulence structure, & to the flow near the surface in a turbulent boundary layer. Long-range plans include the influence of free-stream turbulence & roughness on the structure of turbulence in the boundary layer, & the extension of similar studies to wakes & jets. This investigation is carried out in collaboration with NSRDC with partial support from ERDA. In addition the relatively unexplored turbulence structure of low Reynolds number turbulent boundary layers will be studied using laser velocimetry and hot-wire anemometry.

Progress - FY 1975: The paper entitled 'On the Lognormality of the Small-Scale Turbulence Structure' was completed and published in the March 1975 issue of the journal Boundary Layer Meteorology. Attention was also given to the analysis and reliability of the simultaneous measurements of the three components of turbulent velocity fluctuations. At this stage, the data for the three individual orthogonal velocity components, and their derivatives obtained from the specially designed three-component sensor, is satisfactory. This conclusion involved extensive comparison of the higher-order moments obtained from the three-component sensor with that obtained from the more conventional methods. Some difficulty has been encountered in the measurements of cross correlation. Analysis of the effect of free-stream turbulence level on the small-scale turbulence structure has been initiated. The higher free-stream turbulence was created by fluttering aluminum tags attached to a one-inch square-mesh grid. The lower free-stream turbulence level data were analyzed to yield higher-order moments of the gradient of the longitudinal velocity fluctuation. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

5.0009, FEASIBILITY OF AUTOMATICALLY IDENTIFYING TERRAIN FEATURES AND NATURAL MATERIALS FROM REMOTE SENSING DATA

H.T. RIB, U.S. Dept. of Transportation, Federal Highway Administration, *Washington, District of Columbia* 20590 (020925 (HRB NO.))

The feasibility is being determined: (1) Of automatically identifying terrain features and natural materials, (2) to determine the major parameters affecting automatic data handling and reduction, and (3) to determine the types and amount of ground truth data needed to compliment remote sensor data for proper identification.

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SUPPORTED BY U.S. Dept. of Transportation - F.H.A.

5.0010, WATER RESOURCES OF EVERGLADES NATIONAL PARK, FLORIDA

A.L. HIGER, U.S. Dept. of the Interior, Geological Survey, *Miami, Florida* 33130 (FL 12-048)

Everglades National Park is a 'water' park which historically received inflow, mostly by overland flow from outside its bounds. In some contiguous areas the inflow is regulated by water control works. The purpose of the investigation is to determine the effects of the control works on the seasonality and magnitude of inflow and to furnish and evaluate hydrologic and biologic data to establish a base for the allocation, development, conservation, and management of the water resources of the park to preserve the unique native biota.

(1) Analyze hydrologic data to define the historical water conditions in the park. (2) Define the quantities of water that enter, that are stored within and that move through the park. (3) Evaluate changes in hydrology resulting from past and present water control practices. (4) Define the abundance and types of aquatic organisms present, the changes in chemical constituents in the water and changes in botanical populations. (5) Determine the relations between the quantitative and qualitative water conditions and the biological populations. (6) Evaluate potential water sources within and outside the park. (7) Evaluate botanical changes by use of aerial photography and relate changes to changes in hydrology.

A network of stage, discharge, water quality, and biologic sampling stations have been established to obtain data. Several reports have been prepared that evaluate this data and more reports are anticipated. The reports will cover the field of hydrology, biology, and photointerpretation.

Observation of water level, discharge and water quality continued for this project.

Current observation of water level, discharge, and water quality will continue. ERTS data collection platforms (3) will be installed in the park for timely data acquisition.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0011, ESTUARINE HYDROLOGY OF TAMPA BAY

C.R. GOODWIN, U.S. Dept. of the Interior, Geological Survey, *Tampa, Florida* (FL 12-159)

A comprehensive hydrological investigation of Tampa Bay and its immediate surroundings is necessary to assess the probable effects of a proposed channel dredging project on the interacting hydraulic, chemical and biological systems operating in the Bay. Unanswered technical questions concerning possible groundwater contamination, modified flushing and circulation characteristics, and overall environmental impact; as well as operational needs, such as quantity and placement of dredged material, justify this project.

The specific objectives of this study are: (1) Bathymetric definition of the bay bottom, (2) determination of depth to bedrock, (3) definition of pollutant sources issuing into the bay and their subsequent distribution, (4) development of a management tool to predict the response of the bay to natural and man-made changes--dredging, filling, floods, hurricanes, etc., and (5) determination of optimum channel alignment, quantity of material to be removed, and optimum location and shape of disposal sites.

The following techniques will be used to accomplish the listed objectives: (1) Bay bottom mapping by negative-blue aerial photography and radar located sonic soundings, (2) depth to bedrock by low frequency sonar and core borings, (3) pollutant sources by detailed field survey-- pollutant distribution by large scale water sampling program and best available laboratory analysis techniques, (4) a predictive management tool in the form of a digital model of the hydraulics and quality of Tampa Bay--verification by comparison with real data (velocity, elevation, quality), and (5) optimum dredge operation and fill placement determined by using model to test all suggestions.

Tidal stage and QW monitoring carried out, reports in preparation; bottom maps administratively released, report in preparation; digital model used to help predict impact of harbor deepening project, circulation increases can be accomplished; installation of hurricane warning aid in tide gages.

Completion of data and interpretive reports, continuing use of model, update of bottom maps.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0012, AIRPORT VICINITY AIR POLLUTION

UNKNOWN, Argonne National Laboratory, *Argonne, Illinois* 60439 (045479 (TRAIS NO.))

This study is to identify the pollutant emissions from aircraft in the approach/departure zones and in the areas associated with the holding patterns. Acquiring this information will allow the Environmental Protection Agency (EPA) standards to be revised, if necessary, to conform with more accurate quality standards.

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SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

5.0013, STUDIES OF FIELD ALIGNED CURRENTS AT 800 KM ALTITUDE IN THE AURORAL OVAL USING THE TRIAD SATELLITE

T.A. POTEMRA, Johns Hopkins University, Applied Physics Laboratory, *Silver Spring, Maryland* 20910 (DES73-00593 A03)

Data from the TRIAD satellite will be collected with this grant. These data will be very important to auroral researchers when used in collaboration with ground-based instruments.

SUPPORTED BY U.S. Natl. Science Foundation

5.0014, FINE-MESH LIMITED-AREA MODELS
R. SHAPIRO, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF243900)

AF function - military operations involving Air Force vehicles used by strategic, tactical and general purpose forces. Deficiency - such operations are adversely affected by deficiencies in specifying and predicting winds and weather on time and space scales which are smaller than the typical meteorological observational network. Objective - to enhance the detail of numerical weather prediction. How research contributes - research will improve forecasts on fine-mesh networks over any specific limited area of the earth.

The approach is to carry out numerical solutions of primitive equation mathematical models of the atmosphere over limited areas of the earth. Artificial lateral boundary conditions, which must be specified because of the limited area, tend to produce computational instability and degeneracy in the forecasts. High ordered interpolation and filtering procedures will be investigated as a means of suppressing the lateral boundary instability.

Supporting agency address information: AF Cambridge Research Laboratories LY, L G Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0015, RADAR OBSERVATIONS AND ANALYSIS OF PRECIPITATION PATTERNS
P.M. AUSTIN, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DES75-14135)

The aim of the research is to observe the structure of precipitation in various types, to extract statistics regarding characteristics and behavior of subsynoptic-scale precipitation areas and to interpret observed patterns in terms of associated small-scale circulations.

The work will use a 5-cm radar and digital data processing system, which were acquired for observing tropical showers in GATE, in conjunction with the 10-cm radar previously in operation at MIT to obtain extensive digital data in New England storms. Both these data and the large amounts obtained in GATE will be used in a variety of studies.

The proposed analyses include: (1) Definition of cells and of mesoscale precipitation areas and bands in terms of parameters which permit identification and tracking by computer; (2) Further exploration of the characteristics and behavior of subsynoptic scale precipitation areas; (3) Development of kinematic models to compute three-dimensional distribution of radar reflectivity; (4) Statistics of the small-scale distribution of precipitation; (5) Evaluation of attenuation of 5-cm radiation by rain; (6) Examination of the dependence of measured reflectivities on range; (7) Continuation of analysis of drop-size measurements and Z-R relations; (8) Case studies of selected situations in the GATE area and in New England.

In particular, consideration will be given to well-defined narrow bands and to computations of vertical transports by cumulus cells.

SUPPORTED BY U.S. Natl. Science Foundation

5.0016, HIGH-SPEED ROTOR NOISE RESEARCH
W.L. HARRIS, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 2095)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0017, GLOBAL TRANSPORT PROCESSES AND INTERACTION WITH TRACE CONSTITUENTS
R.E. NEWELL, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (BER-76-40; E (11-1)-2195)

Our objective is to understand the energy budget of the atmosphere- cryosphere-ocean-land system so that we are able to specify the factors that govern temperature and wind velocity in the troposphere and stratosphere. With this and similar information about the momentum and mass budget we shall be able to establish a background of climatic change and the influence on climate of anthropogenic effects, such as production of aerosols, emission of CO2 and emission of waste heat into the boundary layer.

Our procedure is to study global data on wind, temperature, moisture and other trace constituents, and to compute means, variances and covariances, and radiative heating effects and to synthesize as closely as possible the exact global energy budget. We have also constructed a global budget of angular momentum from the wind data and made estimates of the rate of mass exchange between the hemispheres and between the stratosphere and troposphere. The fundamental information can be, and has been, applied to a number of global trace substance problems, such as the circulation of atmospheric ozone, and carbon monoxide.

Results have been incorporated in our 90 reports and published papers and two hardbound books. We believe they have incorporated the first comprehensive study of the tropospheric and stratospheric energy budgets. They have also led to a new view of ice-age formation and disappearance.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - B.E.R.D.

5.0018, MICROWAVE AND DATA RELAY APPLICATIONS OF REMOTE SENSING IN HYDROGEOLOGY
G.K. MOORE, U.S. Dept. of the Interior, Geological Survey, *Bay St. Louis, Mississippi* 39520 (SR 00-034)

Remote sensing, particularly in the microwave part of the spectrum, has considerable potential for hydrogeologic studies. Research and development is needed to obtain operational procedures. Similarly, field experience with various systems is needed to make satellite relay of hydrologic data an operational procedure.

1) Conduct research on the regional applications of remote sensing to hydrology. 2) Originate, plan, and coordinate programs and projects in the field of remote sensing. 3) Develop imagery enhancement and hydrologic interpretation procedures for microwave data. 4) Test the GOES data relay system for operational use.

1) Work with WRD, EROS, and NASA personnel to originate and coordinate remote sensing applications to hydrologic studies. 2) Analyze existing remote sensing data (particularly radar imagery) for content of hydrologic information. 3) Acquire and test two GOES platforms for water quality monitoring.

1. Reports. - Three reports were published; two additional reports were prepared and presently are in review. 2. Talks and briefings - the paper 'Flood Inundation in the Southeastern United States from Aircraft and ERTS Imagery' was presented at the Ninth International Symposium on remote sensing of environment. Ten other talks, briefings and training lectures were prepared and given. 3. Ongoing studies - work was begun on the Skylab Study 'Hydrologic Significance of Faults in the Great Smoky Mountains National Park.' This study will be completed in the 1975 FY. Preliminary results were obtained in several new applications of ERTS imagery for geology and hydrology. Some lecture notes were prepared for a proposed training course in hydrologic remote sensing. 4. District assistance - advice, data searches, or other assistance were provided to eight WRD Districts.

1. Complete Skylab Study. 2. Prepare training manual on hydrologic remote sensing for TWRI series. 3. Complete preparation of lecture notes and workbook for training course on hydrologic remote sensing. 4. Coordinate research efforts of EROS program with remote sensing needs of WRD.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0019, AIR MASS MODIFICATION OVER THE SEA
J.W. TELFORD, Univ. of Nevada, Desert Research Institute, *Reno, Nevada* 89507 (OCD73-00652 A03)

The objective of the proposed researcch is a clearer understanding of the structure and function of the atmospheric boundary layer over the sea using the NCAR Electra aircraft to gather data. The aircraft will measure the vertical flux of horizontal momentum over the entire area to see how representative are the point measurements of this quantity. In addition, the aircraft

will map the sea surface temperature field over the experiment area, enabling the vertical heat flux measurements in the fixed surface network to be related to the mesoscale features of the sea surface temperature field. The aircraft data will also be used to see to what extent spatial variation of the vertical flux of horizontal momentum is related to spatial variation of the sea surface temperature field.

SUPPORTED BY U.S. Natl. Science Foundation

5.0020, FLIR/LASER TERRAIN FOLLOWING
R. PRIBYL, U.S. Army, Avionics Laboratory, *Red Bank, New Jersey* 07703 (DA0D2814)

The general objective is to make a determination of how the added capability of the lotaws as a ranging sensor enhances the functional capabilities of aircraft. Attention will initially be directed upon the integration of the lotaws and the FLIR for T/F operation, although the potential exists for additional functional applications.

A terrain following system utilizing the lotaws sensor and SKC-2000 airborne computer will first be synthesized based on previous simulation analysis. Preliminary testing of the system concept and debugging of various hardware and software will then be achieved during a ground- based check-out simulation. The effort will culminate with the flight test of the system, including several levels of sophistication of T/F concepts, on board the experimental test vehicle.

Supporting agency address information: ECOM Avionics Laboratory, (AMSEL-VL-F), Ft. Monmouth, N. J. 07703

SUPPORTED BY U.S. Dept. of Defense - Army

5.0021, SAMPLING DESIGNS FOR THE SURVEILLANCE OF AIR POLLUTION RESOURCES AND INTENSITY
S. ZACKS, Case Western Reserve Univ., School of Mathematics, *Cleveland, Ohio* 44106 (NSG 3078; 644-02-02)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0022, PROBLEMS IN GATE AIRCRAFT DATA MANAGEMENT
C.E. DUCHON, Univ. of Oklahoma, School of Arts, *Norman, Oklahoma* 75069 (OCD74-16402 A01)

The objective of this research is to calibrate the instrument errors for data obtained on aircraft during the Global Atmospheric Research Program's (GARP) Atlantic Tropical Experiment (GATE). All of the aircraft involved in GATE participated in intercomparison tests by flying past a tower with calibrated instruments on it. Using the data obtained in those tests a numerical model will be used to determine any biases in air temperature, static pressure, dew point, and true air speed. Under the controlled fly by condition the model can be tested and refined. It can then be applied to the large quantity of GATE aircraft data.

SUPPORTED BY U.S. Natl. Science Foundation

5.0023, DATA FOR LANDSAT FOLLOW-ON INVESTIGATION
UNKNOWN, Texas A & M University System, Graduate School, *College Station, Texas* 77843 (NAS 5-22534; 641-15-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0024, TECHNIQUES OF FLOOD-PLAIN MAPPING FOR LAND-USE MANAGEMENT OF FLOOD PLAINS
G.W. EDELEN, U.S. Dept. of the Interior, Geological Survey, *Herndon, Virginia* 22070 (NR 00-057)

Identification of lands subject to flooding is necessary for land- use management on flood plains. Accurate delineation on maps of areas subject to inundation by floods of a given frequency is required-- information on frequency of flood discharges, profiles of water-surface elevations along the channel, and large-scale topographic maps. Information obtained during field surveys is needed for computing water- surface profiles by step-backwater procedures. New techniques of photogrammetry, electronic measurement from aircraft, computation of backwater profiles, and the plotting of maps and cross-sections by computer may offer more efficient means of flood-plain delineation.

To evaluate potential flood-mapping techniques, appraise their accuracy in relation to cost for various uses and time frame in which flood-plain maps are of maximum use, and to investigate means to carry out flood-mapping techniques at an accelerated rate.

Investigate and compare available methods of obtaining data required for preparing maps, charts, and interpretive reports associated with identification of flood-prone areas. Determine the range in costs involved in the conventional aerial photography-stereo model approach of obtaining measurements of valley cross sections. Investigate the potential of the laser altimeter in its application to aerial surveying, and the possibility of direct survey from the air without going through the stereo-model plotting process.

At field office level, analyze accuracy/cost factors of flood-plain mapping studies which use step-backwater computations based on data obtained by conventional surveying methods and by photogrammetric techniques. Evaluate WRD flood-mapping program: identify goals, develop long-range mapping priorities, assess accuracy requirements, and appraise floodway concept. Assuming a favorable report from the contract feasibility study by Draper Laboratory followup contract work will be launched with them to accomplish the engineering design of the complete airborne instrument package.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0025, OPTICAL REMOTE SENSING OF SHALLOW WATER BATHYMETRY
D.S. ROSS, U.S. Dept. of the Interior, Geological Survey, *Herndon, Virginia* 22092 (7-741; 5-15008)

Objective: To determine the feasibility of mapping shallow water depths from high altitude (aircraft and/or satellite optical imagery).

Approach: Imagery from LANDSAT-2, U-2 flights, and the SKYLAB S- 190A multiband photographic experiment will be supplied by NASA to the U.S. Geological Survey. Data is already on hand for the Florida Keys, Puerto Rican Coast, Bimini Banks, and Bahama Banks. Mr. Ross, a nationally known photographic interpretation and enhancement specialist, will enhance S-190, LANDSAT, and U-2 multiband imagery to determine maximum depth penetration and atmospheric haze interference. Hydrographic charts, provided by NESS SPOC, will be used for surface truth comparisons. A report on the results and recommended instrumentation for shallow water depth mapping will be provided.

Future plans: The USGS, NOAA and NASA will consider the results of this project to determine whether LANDSAT-C should carry a multispectral scanning band in the .45 to .55 mm region or any other portion in the blue end of the spectrum which gives optimum depth penetration in water and is not affected by atmospheric haze contrast attenuation.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0026, METEOROLOGICAL ANALYSES AND SURVEYS FOR V/STOL
SPOTTARD, U.S. Energy Res. & Dev. Admin., *Richland, Washington* 20545 (045363 (TRAIS NO.))

This project provides for meteorological tests, experimentation, surveys and analyses in connection with certain aviation weather programs requiring detailed information on the lower levels of the atmosphere.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

5.0027, A LAKE AND SEA ICE EXPERIMENT WITH SKYLAB MICROWAVE IMAGERY
W.J. CAMPBELL, U.S. Dept. of the Interior, Geological Survey, *Tacoma, Washington* 98402 (WR 00-120)

The purpose of the experiment is to determine the feasibility of using passive microwave systems in space to measure and

monitor the characteristics of sea and lake ice and to compare ice parameters with numerical models.

1) To analyze the information content of sequential, synoptic passive microwave data with variations in types and location of ice; 2) To determine the feasibility of a Skylab EREP passive microwave system to obtain significant information on type, areal extent, thickness and condition of ice on Lake Ontario and the Gulf of St. Lawrence; 3) To compare measured results with contemporary models of microwave emission from ice; 4) To evaluate the differences in information content between aircraft and EREP passive microwave data; and 5) To determine instrumentation needs for synoptic ice monitoring systems.

Skylab EREP S193 passive microwave radiometer data will be correlated with airborne PMIS, SLAR, and photography, S190 photography, meteorological data, and ground truth information to determine the nature, extent, thickness, and condition of lake and sea ice. Both visual image comparison and digital computer processing will be utilized. International Field Year for the Great Lakes (IFYGL) scientists from the U.S. and Canada will be used to collect sea, air, ground and snow/ice data. Empirical data will be used to evaluate contemporary numerical models for determining ice conditions.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0028, INTERNATIONAL HYDROLOGICAL DECADE GLACIOLOGY

M.F. MEIER, U.S. Dept. of the Interior, Geological Survey, *Tacoma, Washington* 98402 (WR 00-031)

The program for the International Hydrological Decade recognizes three important projects in glaciology: a. World inventory of perennial and annual snow and ice masses. B. Measurements of glacier variations on a worldwide basis. C. Combined water-, ice-, and heat-balance measurements at selected representative glacier basins.

As part of a coordinated program in Water Resources Research, this project will contribute to the objectives of the International Hydrological Decade. This project forms the major United States program in this field.

Project a.--the distribution, areas, numbers, etc. of glaciers in the United States will be determined from maps and photographs, and these data will be analyzed, interpreted, and published in survey reports. Project b.--we will supply all glacier variation data derived as part of other studies to the permanent service on the variations of existing glaciers (Zurich) in appropriate format. Project c.--we will conduct heat-balance studies on South Cascade glacier, and continue the on-going mass- and water-balance studies there. Mass- and water-balance studies at Maclure, Gulkana, and Wolverine glaciers will be directed at field level by personnel of WRD District Offices in California and Alaska.

Map and water balance data were collected at the South Cascade, Wolverine, and Gulkana Glacier Research Stations. Data analysis is well under way. A paper which reports results from 4 stations in the balance year 1967 was virtually completed. An index glacier system for simplified mass balance results has been devised, to make the transition from the IHD to a modest continuing program of basic data collection. Experiments were performed with ERTS images to see how ERTS data could aid IHD snowline mapping projects. All photos were marked and data extracted and maps were compiled for the inventory of ice masses in the Sierra Nevada. Data have been compiled for more than 500 of these small masses. The Maclure Glacier Station was removed and the area returned to wilderness condition.

Continue data collection for this last summer of the IHD (1974) and complete data analysis and report writing.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0029, EVALUATE ERTS IMAGERY FOR MAPPING AND DETECTION OF CHANGE OF SNOWCOVER ON LAND AND ON GLACIERS

M.F. MEIER, U.S. Dept. of the Interior, Geological Survey, *Tacoma, Washington* 98402 (WR 00-085)

Snow can be measured at a point by many techniques. However, the areal extent of the snow cannot be measured from the ground or from aircraft without the expenditures of enormous funds. Monitoring the everchanging snowcover from the ERTS satellites appears feasible, but not enough is known about the problems involved.

Evaluate the feasibility and probable accuracy of synoptic monitoring of snowcover changes from spacecraft such as ERTS, using visible light.

Acquire ERTS-A imagery as well as high-level (NASA U-2) and low- level aircraft photographs of snowlines together with ground truth data, for typical mountain terrain. Experiment with mapping and time-sequence techniques, including use of automated cloud console at Stanford Research Institute. Then use these data to evaluate feasibility of several techniques.

Snow-covered area in individual drainage basins was measured using a variety of techniques, using optical and electronic interactive console (ESIAC) means; the techniques included simple radiance slicing, radiance-gradient slicing, average snowline altitude determination from maps or a variable contour overlay, equivalent snowline altitude, or slicing by position on a color-space display. Using simplest means (radiance slicing), overall accuracy during melt season was 7 to 10%. ERTS resolution permits useful measurements in basins as small as 6 km(2). Tidal glacier termini could be monitored. The motion of surging glaciers could be measured with an accuracy of about 100 m, and the spreading of zones of crevassing could be observed during a surge.

Put it all together in a final report.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0030, MICROWAVE INVESTIGATIONS OF SNOW AND ICE

M.F. MEIER, U.S. Dept. of the Interior, Geological Survey, *Tacoma, Washington* 98402 (WR 00-092)

Snow varies more rapidly in time and space than any other widespread material on the earth's surface. Therefore one cannot monitor the snow cover properly from a limited number of instrument sites. Existing remote sensing systems using the visible or infrared parts of the spectrum cannot 'see' through clouds (when the important changes take place), and can only reveal the reflectivity or temperature of the outer surface. Microwave radiation penetrates clouds and reveals information from depth within snow, but the physics of microwave emission from snow is complex and barely understood.

To understand how each of the various properties of snow (e.g. density, thickness) influences the emission of microwave radiation from snow/soil systems as functions of frequency, polarization, and viewing angle, and to evaluate the feasibility of using passive microwave techniques for monitoring snowpacks and glaciers for practical or scientific purposes.

Simulate microwave emission measured from NASA aircraft by numerical modelling, compare results to analyze applicability of existing theory and understanding. Monitor contracts used in this work. Communicate and coordinate with others working in this field. Attempt to develop coherent picture of microwave emission and other radiometric properties of snow.

Recalculation of the 3/71 South Cascade glacier overflight data using A.W. England's simple theory of volume scattering shows brightness temperatures which decrease with decreasing wavelength, exactly as observed, whereas a layered dielectric model (without scattering) shows negligible wavelength dependence. Thus the importance of volume scattering in determining microwave emission from snow is proved. Preliminary tests have been made with a portable gamma ray probe, for rapid density-depth profiling in conjunction with microwave and snow wetness experiments. A low frequency, monopulse radar was successfully used to measure the thickness of South Cascade glacier (up to 250 m). This was perhaps the first unambiguous depth sounding of a very wet temperature glacier by electromagnetic means.

Further test monopulse radar, make rigorous volume scattering calculations, and perform simple experiments to check the results (if funds permit).

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0031, A SWEPT-FREQUENCY RADAR SYSTEM FOR SNOWPACK MEASUREMENTS

M.F. MEIER, U.S. Dept. of the Interior, Geological Survey, *Tacoma, Washington* 98402 (WR 00-101)

During the past year theoretical analysis and numerical calculations have been completed for a wide variety of models of air, snow, ice, water, and earth to obtain electromagnetic response as a function of frequency. Electrical parameters of snow and ice were selected so as to cover a wide range of snow types. Many combinations of snow and ice thicknesses were analyzed. The theoretical results have been very encouraging. An experimental program has also been completed during the past year in the Sierras, for snowpacks that were shoveled manually, which showed clear evidence of the dependence of electromagnetic response to snow depth. The important question is: how realistic are the theoretical models? This, and related questions about statistical implications of lake-based data, indicate that a field site survey program should be arranged.

Site surveys could be undertaken to inspect high-altitude lakes in the fall and winter season. Samples of snow and ice profiles will be obtained, at times and locations to be determined. Selection factors include safety, accessibility, transportation costs, relationship to established snow courses, etc. High-altitude meadows will also be inspected in the fall and winter seasons, and evaluated for suitability as sites for the electromagnetic measurements.

Approximately ten lakes and ten meadows will be evaluated. statistical reliability of such information remains to be determined, and will depend on the variance in profiles. If possible, enough samples will be taken at each site to provide reasonable limits on the layering characteristics. Frequency of field trips will depend on the weather pattern.

Methods have been devised to measure radio-frequency attenuation in snow in order to determine the liquid water content, without problems of coupling and reflections. Initial experiments have been performed using a microwave oven as a source, with good results. Instruments and foam rubber (for calibration) have been obtained, theory and design has begun for a field instrument to profile snow wetness. Computations and field tests show that the water equivalent of a snowpack can be measured by its capacitance. Computer calculations have been made to verify the operation of the proposed airborne electromagnetic sounding technique.

Continue cooperative investigations of electromagnetic measurement of snow properties.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, TEMPERATURE EFFECTS ON BACTERIAL LIPID METABOLISM
UNKNOWN, Calif. State Univ. & Colleges, Graduate School, *Hayward, California* 94541 (NCA 2-90602; 192-55-63)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0002, IN VIVO DETERMINATION OF BONE PROPERTIES FROM MECHANICAL MEASUREMENTS
C.R. STEELE, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NSG 2092; 970-21-14)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0003, LIGHT ENERGY CONVERSION IN HALOBACTERIUM
UNKNOWN, Univ. of California, Graduate School, *San Francisco, California* 94122 (NSG 7151; 192-55-64)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0004, OXYGEN EFFECTS AND EARLY BIOCHEMICAL EVOLUTION - ACETYL-COA SYNTHETASES IN YEAST
J.A. NEPTUNE, Calif. State Univ. & Colleges, School of Natural Sci. & Math., *San Jose, California* 95192 (NSG 2090; 970-24-01)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0005, EFFECTS OF OVERT EMOTIONALITY ON REACTIONS TO AIRCRAFT NOISE
M. LOEB, Univ. of Louisville, School of Arts & Sciences, *Louisville, Kentucky* 40208 (NSG 1220; 504-09-11)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0006, ALTERATIONS IN THE MAMMALIAN VESTIBULAR SYSTEM ASSOCIATED WITH CHANGES IN GRAVITATIONAL FIELD
R.G. GRENELL, Univ. of Maryland, School of Medicine, *Baltimore, Maryland* 21201 (NSG 2098; 970-21-11)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0007, INFLUENCE OF VISUAL STIMULATION ON UTULITH-CONTROLLED UNITS
UNKNOWN, Vassar College, Graduate School, *Poughkeepsie, New York* 12601 (NCA 2-23601; 970-21-11)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0008, EFFECT OF BACKSCATTER OF HIGH INTENSITY LIGHT PULSES ON THE HUMAN PILOT
A. ZEINER, Univ. of Oklahoma, School of Medicine, *Oklahoma City, Oklahoma* 73104 (106351 (HRB NO.))

The objectives are: (1) to continue the investigation of the effects of high intensity light pulses on the performance and orientation capability of the human pilot; (2) to determine the effects on pilots of light pulses varying in intensity, up to very bright; (3) to study the effects of backscatter on hyperventilation, vagal tone, and drowsiness of pilots; (4) to investigate effects of color on the physiological responses of pilots to flashing lights; (5) to assess the performance decrement of pilots under conditions of backscatter, using both white and red flashing lights; and (6) to study the feasibility of extension or reduction of excessive brightness of light sources by obstruction of vision at frequencies below, at, or above flicker fusion. Results are being analyzed and a report is being prepared.

Document provided to S.S.I.E. by the H.R.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

6.0009, RIDE QUALITY JUDGMENTS AS A FUNCTION OF ENVIRONMENTAL, PERSONALITY AND RIDE SPECTRA CORRELATES
G.D. COATES, Old Dominion University, Graduate School, *Norfolk, Virginia* 23508 (NSG 1225)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, FACILITIES STUDY OF NAS COMPUTER OPERATIONS
B.L. MCKENZIE, U.S. Air Force, Federal Simulation Center, *Washington, District of Columbia* 20330 (058241 (TRAIS NO.))

FEDSIM will perform a facilities study of the NAFEC Job Shop and 9020 Computer Complex. This study will be an in-depth review of operations, systems, applications, and organizational structure. The primary objective will be to identify short-term improvements to the Job Shop Computer and the 9020 Complex. A

secondary objective will be to recommend long-range improvements to the 9020 Complex.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

7.0002, INTERFACE ARTS III DISPLAY WITH PDP DATA PROCESSING SUBSYSTEM AT NAFEC

UNKNOWN, U.S. Small Business Admin., *Boston*, *Massachusetts* 02114 (058331 (TRAIS NO.))

The DEDS display is an interactive device that operates, in a digital mode, in conjunction with a data processing device; specifically, the UNIVAC ARTS Input/Output Processor (IOP). This effort shall include designing and fabricating a similar interface between the DEC PDP-1145 processor and a DEDS display. The interface design will include hardware- or software-based data refresh techniques (hardware techniques may be used if solely software methods prove ineffective). Display data, written in beacon sweep dead time, shall be refreshed at a 30 Hz rate for a nominal load to be determined by the contractor. A planned degradation of the data displayed shall be incorporated when the nominal load is exceeded.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THE RESPONSE OF SUPERCONDUCTORS TO VARIATIONS IN IMPURITY CONTENT AND APPLIED PRESSURE

H. SUHL, Univ. of California, Inst. For Pure & Ap. Phys. Sc., *San Diego*, *California* 92038 (E(04-3)-34PA227)

An experimental program is proposed to study the phenomenon of superconductivity to very low temperatures and high pressures, and will incorporate experiments testing the response of superconducting materials to bulk compositional variations and the introduction of local magnetic perturbations. First, we plan to further develop the systematics of superconductivity in the presence of paramagnetic impurities with the aim of establishing a 'superconducting spectroscopy' for determining the magnetic state of local moments in metals. We intend to extend our studies of superconducting Kondo systems with multiple transition temperatures, magnetic-nonmagnetic transitions of impurities in superconductors, and superconductors containing rare earth impurities with crystal-field split energy levels. We also propose to study the effect of particular magnetic impurities on the superconducting properties of various A15 high-temperature superconductors to search for systematic behavior which might yield information pertaining to their high critical temperatures. We intend to study the superconductivity of the soft superconductors Zn, Cd, and Al to determine the detailed superconducting-normal state phase boundaries on the temperature-pressure plane to make comparisons with existing theory and determine whether pressure can destroy superconductivity in these elements. Experiments are also proposed to investigate the superconductivity of lamellar graphite compounds under pressure.

Results: Results have recently been obtained which suggest that a new electron pairing mechanism, involving inelastic charge scattering of conduction electrons from the aspherical part of the 4f shell, may account in part for the superconductive properties of the (LaPr)Sn3 system in which the Pr impurity has a singlet ground state. The initial report of this work will soon appear in Phys. Rev. Letters. Data bearing on the possible superconductivity of elemental Au are being accumulated through studies of the pressure dependence of the superconducting transition temperature of concentrated Au alloys at low temperatures. Data are presently being taken on (La,Th)Ce alloys to test recent theories of superconductivity throughout the entire manifold between magnetic and nonmagnetic Ce impurity behavior. (Text Abridged)

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0002, THERMOCHEMICAL MEASUREMENTS & STANDARDS

G.T. ARMSTRONG, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington*, *District of Columbia* 20234 (3161112)

Objectives: The objectives of this section are to provide measurement standards for thermal and thermochemical measurements for the nation and to provide thermochemical measurements in materials and processes important in the national technology. In order to do this the section develops and maintains state-of-the-art calorimeters; adiabatic solution calorimeter, microcalorimeters, drop calorimeters, bomb calorimeters, flow combustion calorimeter, dynamic calorimeter, to make heat measurements and transpiration and millisecond (development of microsecond) apparatus, to measure the thermophysical properties of liquids and solids above 1500 K. These various apparatuses are used to develop and certify SRM's and measurement techniques for the uses of technology. An active research program is being pursued in the determination of thermophysical properties of metallic conductors, enthalpies of formation of organic and inorganic molecules, enthalpies of solution, heat developed in chemical and biochemical (including enzymatic) reactions, determination of the vibrational spectra and symmetry of high temperature molecules (input data for thermodynamic computations), and transpiration measurement of chemical equilibria. Other efforts in evaluating and correlating thermodynamic properties of materials important to high-temperature rocketry, chemical laser applications, and biomedical needs are used as an adjunct to the experimental program. Progress (July 1974 - June 1975): 1) The specific heat, electrical resistivity and hemispherical total emittance of two grades of graphite, vanadium, and zirconium were measured using the pulsed high speed millisecond apparatus previously developed. 2) The melting point and brightness temperature (at the melting points) of zirconium and niobium were measured. 3) The temperature, energy, and electrical resistivity of zirconicum during a solid-solid phase transition were measured. 4) Heat capacity, electrical resistivity and hemispherical total emittance of hafnium (1500 - 2400 K) and molybdenum (1500 - 2800 K) were measured using the high-speed (subsecond) apparatus previously developed. The work on molybdenum was in connection with heat capacity SRM. 5) The temperature and the energy of the solid-solid phase transformation in hafnium were measured. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0003, HIGH-TEMPERATURE SHOCK TUBE STUDIES OF LIGHT SCATTERING AND ABSORPTION INDUCED BY COLLISIONS

T.D. WILKERSON, Univ. of Maryland, School of Arts & Sciences, *College Park*, *Maryland* 20742 (ENG75-07799)

The research will study light scattering induced by collisions and absorption induced by collisions at high temperatures where the effect of overlap interactions become more pronounced. Specific experiments are made possible at high temperatures and pressures by using a shock tube as the gas cell. Light scattering induced by collisions experiments will be done from room temperature to temperatures near 1000 degrees K by essentially standard techniques. A major objective of the program is to determine the role of overlap interactions in inducing a dipole and anisotropy in colliding pairs. Another objective is to determine the form of the overlap part of intermolecular potential by means of collision-induced absorption. The program will require the development of a new apparatus and appropriate techniques. These can be met by rather direct extensions of available techniques and components. At the same time experimental requirements and apparatus design will be assessed for using the shock tube gas cell for higher temperatures. The results will allow the pursuit of collision induced light scattering or absorption which offers the greater promise as the next step in the research.

The research will be conducted at the University of Maryland and the National Bureau of Standards.

SUPPORTED BY U.S. Natl. Science Foundation

8.0004, INFRARED EMISSION RESULTING FROM FUEL-OXIDIZER REACTIONS 6563-P

M.A. BIONDI, Univ. of Pittsburgh, School of Arts, *Pittsburgh*, *Pennsylvania* 15213 (DA0E5576; DA-31-124-ARO(D)-440)

The emission of infrared radiation arising from a variety of fuel- oxidizer systems, at pressures between 0.1 and 20 torr (equivalent altitudes of 25 to 50 km) is measured in a versatile discharge-flow system at wavelengths from 1.1 to 6.5 millimicrons in order to examine both thermal and chemiluminescent emission due to various stable product and reactive intermediate species.

The radiation is produced in a small mixing region in rapid flow, dispersed with cooled circular variable filters of 0.02 to 0.10 millimicrons bandpass, and detected with good space resolution-limited INSB detectors and matched, cooled preamplifiers. Absolute emission intensities are measured and the decay of the emission due to radiation or quenching is also determined along the flow tube.

Supporting agency address information: AMC Army Research Office, Durham, N.C. 27706

SUPPORTED BY U.S. Dept. of Defense - Army

8.0005, URANIUM ATOM REACTIONS AND URANIUM OXIDE PLASMA CONFINEMENT & SURFACE IONIZATION AEROSOL DETECTOR

W.L. FITE, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh, Pennsylvania* 15260 (GP 42012)

Description: Uranium Atom Reactions. This program is studying associative ionization between U atoms and radicals and other species which can be used to produce uranium oxide ions. Plasmas containing these ions are being built up and stored in a magnetic bottle. The ion plasma will first be used to determine the optical spectroscopy of UO ions and UO(2) ions to search for lines and bands that can be used to excite ions containing only one of the uranium isotopes, after which the excited ion can become neutralized by reaction with gas added to vacuum containing the magnetic bottle. The object is to determine whether laser isotope separation can be performed economically using these uranium molecular ions which are energetically forbidden from dissociative recombination and most other neutralizing reactions, when in their groundstate. Surface Ionization Aerosol Detector. Submicron particles are directed to a heated surface where they decompose and surrender surface ionizable impurities to the surface. The impurities are then ionized and a burst of ions from the surface is detected electrically. The device is particularly responsive to coal smoke and other aerosols containing alkali atom impurities, and detect, in real time, particulates down into the centimicron range. Prototype devices have been operating to detect urban air, and models are being designed to use in balloon parachute experiments in the stratosphere and on rockets in the upper atmosphere.

SUPPORTED BY U.S. Natl. Science Foundation

8.0006, RESEARCH INITIATION FOR MINORITY INSTITUTION IMPROVEMENT - NUCLEAR MAGNETIC RESONANCE STUDY OF AMORPHOUS TRANSITION METAL AND ALLOY FILMS

K.S. HAN, Hampton Institute, Graduate School, *Hampton, Virginia* 23368 (HES73-05989)

We propose to investigate the amorphous transition metals and their alloy films in the following manner: In the first stage, we produce the amorphous films for the transition metals vanadium, niobium, platinum and their alloys, (such as VTi, VFe, VGe, NbGe), onto a cold substrate with RF sputtering process or the electron beam evaporation technique. In terms of nuclear magnetic resonance properties, vanadium, niobium and platinum seem to be the best candidates. In the second stage, we will investigate Knight shift and susceptibility of the amorphous phase of the transition metal and allow films by nuclear magnetic resonance. The Knight shift and its variation with temperature gives very useful information about electronic density of states and the hyperfine interaction which may help to answer a number of questions about the electronic structure of the amorphous phase. Amorphous vanadium oxides have excited interest for switching applications because vanadium oxides change from insulator to metal at temperatures near 180 degrees K. The transition metals and alloys are interesting for strain gauge materials.

SUPPORTED BY U.S. Natl. Science Foundation

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, TECHNOLOGICAL TRANSFER AND CHANGES IN THE PERCEPTION OF TECHNOLOGY AMONG AMERICAN ENGINEERS IN THE TWENTIETH CENTURY

D.F. NOBLE, Univ. of Rochester, Graduate School, *Rochester, New York* 14627 (91-36-72-39)

This study of past applications of the technology of business and industry to social problems focuses on three questions: (1) How has the engineer's definition of a technological problem changed during this century? (2) What has he learned from his experience in social engineering about the social and political significance of his skills and his social identity and role as a technologist? (3) What insights has he gained about the nature of modern science and technology, its habits of thought, and its modes of perception? The underlying assumption is that changes in technologists' perceptions of technology signal significant changes in technology.

The researcher is interviewing displaced aerospace engineers in Boston, and a group of engineers and government and corporate officials associated with an experiment in California in 1964 to apply techniques of the aerospace industry to transportation, waste management, and crime prevention. Additional information is being gathered from trade journals and other published sources.

SUPPORTED BY U.S. Dept. of Labor

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, MAGNETOSPHERIC SUBSTORMS IN CONJUNCTION WITH SATELLITE DATA, SUBSTORM-TERRESTRIAL RELATIONSHIP & AURORAL EXCITATION PROCESSES

S. AKASOFU, Univ. of Alaska, Geophysical Institute, *College, Alaska* 99735 (E(45-1)-22290 05)

The objectives of the proposed contract are to work jointly with scientists in the Los Alamos Scientific Laboratory and the Lawrence Livermore Laboratory on a variety of geophysical phenomena which might give us some insight into problems associated with thermonuclear energy production. Specifically, we are interested in basic processes associated with the solar wind (plasma)-magnetosphere dynamo and also in the emission of the auroral green line (5577A). It is proposed to study the distribution of plasmas in the magnetosphere on the basis of the IMP-I,J, Vela and ATS-5 satellites and also photochemical processes which lead to the excitation of oxygen atoms.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

10.0002, A MEASUREMENT OF THE COSMIC RAY ENERGY SPECTRUM FROM 10 TO THE 11TH POWER TO 10 TO THE 16TH POWER EV

T.C. WEEKES, Smithsonian Institution, *Tumacacori, Arizona* 85640 (SRF 0460135)

The spectral exponent of the primary cosmic-ray energy spectrum between 10 to the 11th power and 10 to the 16th power eV will be measured with the atmospheric Cherenkov light technique. This important measurement will be undertaken at the Gamma-Ray Facility at the Smithsonian Institution's Mt. Hopkins Observatory in southern Arizona and will use the 10-m optical reflector and some smaller instruments. A preliminary experiment has shown that this is a feasible technique; With the cooperation of the cosmic-ray groups at the University of Arizona, Tucson, and the University of Durham, England, an experiment will be performed in the winter of 1975-76 that will provide the definitive measurement in this energy range. This proposal is for funds to ensure that the data taken are of the highest quality. The results could confirm the prediction that the lower energy cosmic radiation originates in nearby pulsars.

SUPPORTED BY Smithsonian Institution

10.0003, STUDIES OF SOLAR SYSTEM OBJECTS WITH THE NEW HAT CREEK MILLIMETER WAVE LENGTH RADIO INTERFEROMETER
S. SILVER, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (NSG 7152; 196-41-82)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0004, THREE-DIMENSIONAL STUDY OF SOLAR OSCILLATION
R.K. ULRICH, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (NSG 7158; 188-38-53)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0005, DATA ANALYSIS OF MARINER 10 IMAGERY OF MERCURY
B.C. MURRAY, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (NSG 7155; 820-08-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0006, A THEORETICAL INVESTIGATION OF THE COMPOSITION AND STRUCTURE OF COMETS
D.A. MENDIS, Univ. of California, Graduate School, *San Diego, California* 92038 (MPS74-23501)

Support is for a theoretical research program on the composition and structure of comets. The research will be concerned mainly with (a) the physical and dynamical processes in cometary atmospheres and ionospheres; (b) the comet solar wind interaction, especially the structure and stability of the interface between the cometary and interplanetary plasma; (c) the morphology and generation of cometary magnetic fields and their effects on the plasma dynamics of the tail; and (d) the genetic relationship between comets and other small bodies in the solar system.

SUPPORTED BY U.S. Natl. Science Foundation

10.0007, ANALYSIS OF LUNAR MARE EMPLACEMENT
R. GREELEY, Univ. of Santa Clara, Graduate School, *Santa Clara, California* 95053 (NSG 7141; 383-20-02)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0008, ANALYSIS OF JUPITER DATA FROM RADIO ASTRONOMY EXPERIMENT SPACECRAFT
T.D. CARR, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (NSG 7143; 385-41-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0009, SOLAR, INTERPLANETARY AND MAGNETOSPHERIC STUDIES WITH ENERGETIC PARTICLES
J.A. SIMPSON, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (DES75-20407)

The central themes of the research supported in this grant are a) the search for the basic charged particle acceleration mechanisms on the Sun, b) studies of the physics of the heliosphere and interplanetary medium which relate or couple solar high-energy phenomena to energetic processes in planetary magnetospheres, and c) the isotopic and chemical composition of the source material accelerated in solar flares.

These broad themes translate into these specific goals: 1. Experimental and theoretical studies of the solar flare mechanism with the main emphasis based on the analysis of the isotopic composition of hydrogen and helium and the differential energy spectra of these isotopes. 2. Solar particle propagation in the corona and interplanetary space based on observations from spacecraft distributed throughout the inner solar system. 3. Studies of the eleven-year changes in the heliosphere based upon the solar modulation of galactic cosmic rays and the propagation of solar flare particles. 4. Operation of the Climax and Huancayo Neutron Intensity Monitor Stations.

SUPPORTED BY U.S. Natl. Science Foundation

10.0010, INVESTIGATION OF STELLAR CORONAE WITH THE COPERNICUS SATELLITE
R.C. HENRY, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (NSG 5078)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0011, NUMERICAL STUDY OF THE ATMOSPHERIC CIRCULATION OF VENUS
E.K. RIVAS, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (NSG 5076; 404-02-01)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0012, MISSION-ORIENTED STUDIES OF PLANETARY BIOLOGY
J.F. DANIELLI, Worcester Polytechnic Inst., Graduate School, *Worcester, Massachusetts* 01609 (NSG 7154; 192-55-9X)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0013, THE STRUCTURE OF PLANETARY ATMOSPHERES
T.M. DONAHUE, Univ. of Michigan, School of Arts, *Ann Arbor, Michigan* 48104 (DES75-21049)

This Grant funds interdisciplinary studies aimed at the understanding of planetary atmospheres. In the context of the group involved, this definitely includes the atmosphere of the third planet, earth. The work of Dr. Donahue and colleagues will be directed toward the physical modeling which brings together and minimizes the utility of work by a number of able researchers at the University of Michigan. The past results give promise of continued success.

SUPPORTED BY U.S. Natl. Science Foundation

10.0014, PHYSICAL STUDIES OF PLANETARY SURFACES
J.F. VEVERKA, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (NSG 7156; 384-50-80)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0015, ANALYSIS & SYNTHESIS OF APOLLO LUNAR SURFACE EXPERIMENTS PACKAGE SUPRATHERMAL ION
J.W. FREEMAN, Rice University, Graduate School, *Houston, Texas* 77001 (NSG 7157; 383-20-03)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0016, REFLECTANCE SPECTROSCOPY OF LUNAR SAMPLES
J.B. ADAMS, Univ. of Washington, Graduate School, *Seattle, Washington* 98105 (NSG 9032; 388-10-03)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N75-32001# Advisory Group for Aerospace Research and Development, Paris (France).
TWO-DIMENSIONAL SHOCK WAVE-BOUNDARY LAYER INTERACTIONS IN HIGH SPEED FLOWS
J. J. Ginoux, ed. (Von Karman Inst. for Fluid Dyn.) and R. H. Korkegi, ed. (ARL) Jun. 1975 117 p refs
(AGARD-AG-203; AGARDograph-203) Avail: NTIS HC $5.25

Two dimensional supersonic interactions are reviewed, including separation for laminar and turbulent flows. Theoretical developments in interacting flows are discussed, along with numerical techniques for calculating these flows, using finite difference and integral methods. Experimental studies are also presented which were directed toward understanding the fluid mechanics of attached and separated regions of shock wave-boundary layer interaction in the supersonic and hypersonic flow. For individual titles, see N75-32002 through N75-32007.

N75-32002 Aerospace Research Labs., Wright-Patterson AFB, Ohio.
THEORETICAL MODEL FOR VISCOUS INTERACTIONS **c02**
Wilbur L. Hankey, Jr. *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in High Speed Flow Jun. 1975 p 2-13 (For availability see N75-32001 23-01)

Theoretical development employing the boundary layer equations for interacting flows is discussed. Although differences in details exist between the various approaches, a general recipe has evolved for solving this class of flows, and a procedure was developed which nearly guarantees success. The following is a list of the necessary ingredients: (1) boundary layer program; (2) simple inviscid equation; (3) couple the boundary layer with the inviscid flow and solve simultaneously; (4) initiate the program with arbitrary initial conditions and iterate on these until the desired downstream boundary condition is satisfied, and (5) computing the reversed flow region. Author

N75-32003 Aerospace Research Labs., Wright-Patterson AFB, Ohio.
SPECIAL TOPICS **c02**
Wilbur L. Hankey, Jr. *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in High Speed Flows Jun. 1975 p 13-40 refs (For availability see N75-32001 23-01)

Two integrodifferential equations for the shear stress and heat transfer at the wall are included in place of the set of partial differential equations. The integral form is most useful when employing approximate techniques in that an integration tends to compensate for errors whereas a differentiation magnifies inaccuracies. Author

N75-32004 Calspan Corp., Buffalo, N.Y.
THE DEVELOPMENT OF MODELS OF SHOCK WAVE BOUNDARY LAYER INTERACTION **c02**
Michael S. Holden *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in High Speed Flow Jun. 1975 p 42-44 (For availability see N75-32001 23-01)

Theoretical study of shock wave-turbulent boundary layer interaction in supersonic and hypersonic flows in presented. The Crocco-Lees method in a modified form was used successfully to describe complete regions of shock wave-laminar boundary layer interaction in supersonic flow, if the mixing rate parameters were deduced from experiment. The analyses, to describe laminar and turbulent boundary layer separation, contain most of the features which are now used in analysis of viscous interaction regions. J.A.M.

N75-32005 Calspan Corp., Buffalo, N.Y.
EXPERIMENTAL FACILITIES AND MEASUREMENT TECHNIQUES **c09**
Michael S. Holden *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in high Speed Flows Jun. 1975 p 44-48 (For availability see N75-32001 23-01)

Most early experimental studies of laminar and turbulent separated regions were conducted in conventional continuous or blowdown tunnels; there is an increasing use of facilities such as shock tunnels, gun tunnels, and Ludwieg tubes to achieve high Reynolds and Mach numbers. These latter facilities are discussed. Heat transfer instrumentation is studied, along with surface and flow field pressure measurements. Total temperature and hot-wire anemometer measurements are considered; finite span effects are also examined. J.A.M.

N75-32006 Calspan Corp., Buffalo, N.Y.
SHOCK WAVE-LAMINAR BOUNDARY LAYER INTERACTIONS **c02**
Michael S. Holden *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in High Speed Flows Jun. 1975 p 48-58 (For availability see N75-32001 23-01)

Qualitative features, strong interaction regime, leading edge bluntness, and surface curvature effects of shock wave-laminar boundary layer interactions were studied. Solutions in the weak regime interaction regime, strong interaction regime, and normal pressure gradient were compared to experimental measurements of the integral forms of the boundary layer equations. J.A.M.

N75-32007 Calspan Corp., Buffalo, N.Y.
SHOCK WAVE-TURBULENT BOUNDARY LAYER INTERACTIONS **c02**
Michael S. Holden *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in High Speed Flows Jun. 1975 p 58-110 refs (For availability see N75-32001 23-01)

Boundary layer transition was studied at high speeds. Heat and skin friction measurements were compared with turbulent theories. Incipient separation, separated turbulent interaction regions, and unsteady characteristics of turbulent separated interaction regions were also investigated. J.A.M.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N75-32008 Ohio State Univ., Columbus.
AN ANALYSIS OF HEAT TRANSFER ON A JOUKOWSKI AIRFOIL WITH SEPARATION AND REATTACHMENT Ph.D. Thesis
Lucien Louis Debruge 1975 118 p
Avail: Univ. Microfilms Order No. 75-19428

An analytical method depicting a two-dimensional incompressible, steady state flow over the convex side of a Joukowski airfoil on which a large separation bubble has developed is formulated. The vortex strength generating the flow recirculation inside the bubble and the perturbation of the inviscid velocity distribution outside the separation bubble is such that the calculated separation of the boundary layer on the cylinder in cross flow occurs in the vicinity of the experimentally observed separation at a Reynolds number of 10. The Bachelor representation of a recirculating confined flow at high Reynolds numbers is adopted for the analysis of the flow in the separation bubble. With the vorticity and the entropy of the rotating core assumed constant, the heat transfer coefficient on the closed streamline representing the separation bubble contour is calculated for constant wall temperature and a Prandtl number of 0.71.
Dissert. Abstr.

N75-32009 University of Southern Calif., Los Angeles.
LOW REYNOLDS NUMBER COMPRESSIBLE FLOW THROUGH LONG TUBES WITH VELOCITY SLIP Ph.D. Thesis
Roger Carver Bartlett 1975 175 p
Avail: Univ. Microfilms Order No. 75-19001

Results are presented of a study of low Reynolds number, compressible flow, through long axisymmetric straight tubes with velocity slip at the walls and with zero velocity slip. The boundary layer equations, obtained from the Navier-Stokes equations by slender channel ordering are used together with the energy equation and appropriate slip velocity and temperature boundary conditions. A finite difference digital computer program is employed to solve the flow field. Integration of the equations proceeds along the tube, from known reservoir conditions with a uniform entering velocity profile, using a marching technique with variable grid spacing in the axial and radial directions. Validation of the tube flow analytical model is provided by correlation of experimental data. Dissert. Abstr.

N75-32010 Pennsylvania State Univ., University Park.
UNSTEADY VORTEX LATTICE TECHNIQUES APPLIED TO WAKE FORMATION AND PERFORMANCE OF THE STATICALLY THRUSTING PROPELLER Ph.D. Thesis
Gerald Forrest Hall 1974 199 p
Avail: Univ. Microfilms Order No. 75-19764

The application of vortex lattice techniques to the problem of describing the aerodynamics and performance of statically thrusting propellers was studied. A numerical lifting surface theory to predict the aerodynamic forces and power, including corrections for viscous effects, was performed. The lifting surface was replaced by a twisted flat plate which reflects the radial twist distribution of the propeller blades. The chordwise and spanwise loading was then modelled by bound vortices fixed to the flat plate surface. Particular attention was paid to the formation of the wake. The wake was generated in time and allowed to deform under its own self-induced velocity field as the motion of the propeller progressed. Thus the time history of its shape as well as the inflow at the blades was known. Dissert. Abstr.

N75-32011 Princeton Univ., N.J.
ANALYTICAL STUDY OF THE AERODYNAMIC COUPLING OF HELICOPTER ROTOR BLADES IN HOVER FLIGHT Ph.D. Thesis
Petrus Antonius Maria Spierings 1974 120 p
Avail: Univ. Microfilms Order No. 75-20665

The strong tip vortices of modern rotory wing aircraft cause nonuniform inflow at the rotor plane. Rotor blades which flap in this velocity field experience rapidly changing aerodynamic moments about the blade root. The primary contributor to this induced nonlinear moment is the tip vortex of the preceding blade. The rotor wake interaction was studied with an approximate analytical wake model. The aerodynamic moment induced by the wake about the blade root of a single blade is derived and the effects of stall and blade tip vortex core intersection is determined. It is found that multi-equilibrium flapping angles can exist because of the nonlinear aerodynamic moment. For a rotor, it is established that the wake can couple the blades aerodynamically. The performance of aerodynamically coupled rotor blades agrees with experiments. The stability of the rotor system is shown to depend on blade number, blade loading, Mach number and Lock number. The destabilization phenomena of the aerodynamically coupled rotor is blade flapping at subharmonic frequencies. Dissert. Abstr.

N75-32012# National Aerospace Lab., Tokyo (Japan).
PRESSURE DISTRIBUTIONS ON THE SURFACE OF EXTERNALLY-BLOWN FLAP
Norio Inumaru, Kiyomi Kitamura, and Hitoshi Takahashi Mar. 1975 22 p refs In JAPANESE; ENGLISH summary
(NAL-TR-410) Avail: NTIS HC $3.25

Wind tunnel measurements of a jet engine model and a two dimensional wing model equipped with the pressure orifices on the airfoil contour of its mid span were made to determine surface pressure distribution on externally blown flap (EBF) configurations. A fan jet engine model was placed in various angles and positions relative to the wing, and was traversed along the wing span across the free stream. Surface pressure distribution on the wing model was measured to investigate aerodynamic interference between the wing and the engine. Special features of pressure distribution corresponding to each type of EBF classified were revealed. An augmented lift was supplied by the integration of surface pressure. A discussion is presented on the EBF lift augmentation in comparison with the deflected slipstream concept. Effects of wing-sweep on the surface pressure were also examined using the measurements. Author

N75-32013# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE SHAPE OF A MINIMUM DRAG BODY IN A HYPERSONIC GAS FLOW
V. L. Berdichevskii [1975] 7 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. Mat. Mekhan. Astron. Fiz. Khim. (Moscow), no. 3, 1975 p 90-96
Avail: NTIS HC $3.25; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The hypersonic gas flow around a body in a Cartesian x, y, z coordinate system is considered. The formula for defining the force acting from the stream on the body is given, and a solution is found for the three dimensional problem about the minimum of the force in a class of surfaces of bounded area, and it is proved that the corresponding surface makes the force a minimum. Author

N75-32014# Advisory Group for Aerospace Research and Development, Paris (France).
RECOMMENDED PROCEDURES FOR PROCESSING ACCELERATION DATA OBTAINED BY AIRCRAFT DURING ATMOSPHERIC TURBULENCE ENCOUNTER
John C. Houbolt (Aeron. Res. Assoc. of Princeton, Inc., N. J.) Jul. 1975 15 p refs
(AGARD-R-631) Avail: NTIS HC $3.25

Recommendations are given for processing vertical acceleration data obtained during turbulence encounter of aircraft in service operation to obtain useful structural design information for gust encounter. Specific data reduction procedures are recommended. A key point in the recommendations is that all data processing be done on a consistent basis. Charts and steps for data reduction are presented to achieve this goal. Author

N75-32015# Advisory Group for Aerospace Research and Development, Paris (France).
MATHEMATICAL MODELING AND RESPONSE EVALUATION FOR THE FLUCTUATING PRESSURES OF AIRCRAFT BUFFETING

John C. Houbolt (Aeron. Res. Assoc. of Princeton, Inc., N. J.) Jul. 1975 14 p
(AGARD-R-630) Avail: NTIS HC $3.25

The mathematical modeling used to describe the pressure fluctuations in various turbulent flow problems is reviewed; attention is focused mainly on statistical descriptions such as are involved in power spectral approaches. These models were used as building blocks to synthesize a mathematical model describing the turbulent pressure fluctuations during buffeting of an airplane wing. Means for evaluating the dynamic response of the structure due to the buffeting forces were developed. An example treatment shows that the dynamic response may be an appreciable percent of an associated reference static deflection. It is recommended that a series of controlled buffet tests be made to check on the validity of the equations, and to establish their parameters. Author

N75-32016*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WIND TUNNEL INVESTIGATION OF A LARGE-SCALE UPPER SURFACE BLOWN-FLAP MODEL HAVING FOUR ENGINES
Kiyoshi Aoyagi, Michael D. Falarski, and David G. Koenig Jul. 1975 69 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62419; A-6003) Avail: NTIS HC $4.25 CSCL 01A

Investigations were conducted in the Ames 40- by 80-Foot Wind Tunnel to determine the aerodynamic characteristics of a large-scale subsonic jet transport model with an upper surface blown flap system. The model had a 25 deg swept wing of aspect ratio 7.28 and four turbofan engines. The lift of the flap system was augmented by turning the turbofan exhaust over the Coanda surface. Results were obtained for several flap deflections with several wing leading-edge configurations at jet momentum coefficients from 0 to 4.0. Three-component longitudinal data are presented with four engines operating. In addition, longitudinal and lateral data are presented with an engine out. The maximum lift and stall angle of the four engine model were lower than those obtained with a two engine model that was previously investigated. The addition of the outboard nacelles had an adverse effect on these values. Efforts to improve these values were successful. A maximum lift of 8.8 at an angle-of-attack of 27 deg was obtained with a jet thrust coefficient of 2 for the landing flap configuration. Author

N75-32017*# Georgia Inst. of Tech., Atlanta.
OPTIMUM PERFORMANCE AND POTENTIAL FLOW FIELD OF HOVERING ROTORS Final Report
J. C. Wu and R. K. Sigman 24 Sep. 1975 93 p refs Sponsored in part by Army
(Contract NAS2-6340)
(NASA-CR-137705) Avail: NTIS HC $4.75 CSCL 01A

Studies of rotor and propeller performance and induced potential flow fields were made on the basis of a rotating actuator disk concept, with special emphasis is placed on rotors hovering out of ground effect. A new theory for the optimum performance of rotors hovering OGE was developed. An extended theory for the optimum performance of rotors and propellers in axial motion is presented. Numerical results are presented for the optimum distributions of blade-bound circulation together with axial inflow and ultimate wake velocities for the hovering rotor over the range of thrust coefficient of interest in rotorcraft applications. Results of the optimum performance study show that improvements made possible by the present performance theory, which fully account for the effects of slipstream rotation, is important to the optimum circulation as well as to the power and the thrust requirements of the rotor in the higher thrust coefficient range. A number of explicit formulae useful in computing rotor and propeller induced flows are presented for stream functions and velocities due to distributions of circular vortices over axisymmetric surfaces. Author

N75-32018*# Tennessee Univ. Space Inst., Tullahoma.
PROGRAM TO STIMULATE GRADUATE TRAINING IN THE FIELD OF AEROACOUSTICS Semiannual Status Report, 1 Mar. - Sep. 1975
Robert S. Becker 1 Sep. 1975 13 p ref
(Grant NGR-43-001-135)
(NASA-CR-119136) Avail: NTIS HC $3.25 CSCL 01A

An experiment is reported to cross correlate the output of hot film probes located at various points in the flow field of a jet-blown flap with the output of microphones in the acoustic far field. Fluid dynamic measurements of the flow fields of the test configuration are reported. F.O.S.

N75-32019*# Aerotherm Acurex Corp., Mountain View, Calif.
JANNAF BOUNDARY LAYER INTEGRAL MATRIX PROCEDURE Final Report
R. Michael Evans Jul. 1975 43 p refs
(Contract NAS8-30930; Proj. 6383)
(NASA-CR-143947; Aerotherm-75-152) Avail: NTIS HC $3.75 CSCL 20D

Accurate predictions of the thrust loss due to boundary layer effects and of the wall heat flux are very important to the design and performance evaluation of rocket nozzles. A method used in analytical procedures for liquid fuel rocket engine performance prediction and evaluation is presented. A computer program is examined that is a fast and accurate procedure for solving the set of boundary layer equation (momentum, energy, and species) for laminar or turbulent, chemically reacting flows with a wide variety of boundary conditions. Results of comparison of the various turbulent models are presented. A summary of the modifications and additions to the program is examined. Author

N75-32020*# Flow Research, Inc., Kent, Wash.
THE SIMULATION OF TURBULENT BOUNDARY LAYER SEPARATION ON MULTI-ELEMENT INFINITE SWEPT WINGS
F. A. Dvorak and E. W. Geller Mar. 1975 21 p refs
(Contract NAS2-7048)
(NASA-CR-137694; Rept-70) Avail: NTIS HC $3.25 CSCL 01A

An improved method of simulating the effect of flow separation on potential flow over two-dimensional and infinite swept multi-element wings was developed. Two types of flow separation are considered: at the wing trailing edge, and at the cove region between the main wing and the flap. Potential flow is assumed outside the boundary layer and the separated wake. A previously obtained computer program (VIP) is modified by matching the outflow distribution for the potential flow such that the potential flow part of the real flow is duplicated and the results agree with the experimental observations. Results are given for the NACA 2412 airfoil. Iterative drag calculations are presented. Y.J.A.

N75-32021# Israeli Government, Tel-Aviv.
ON THE DYNAMIC RESPONSE OF MISSILES WITH VARYING ROLL RATES
Ben Zion M. Naveh and Raymond M. Brach (Notre Dame Univ.) 29 May 1975 39 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal on Jan. 1976
Avail: NTIS HC $3.75

An analytical solution is given for the response of a finned stabilized axisymmetric rolling missile due to small asymmetries. The analysis is made separately for configurational or inertial asymmetry in the presence of increasing or decreasing roll rate, where the roll rate is varied exponentially. The solution obtained enables one to find the responses for combinations of the above cases, and for zero and nonzero initial conditions. Design curves are given to show the reduction in maximum response in comparison with steady state linear theory predictions. Also shown is the time shift of the maximum response occurrence along the trajectory. It was found that the response is reduced as the roll damping moment is increased. The reduction in peak response is mostly noticed for low yaw damping moments. It was found that while the steady state linear theory yields pessimistic maximum responses, the constant roll acceleration approach leads to optimistic maximum responses. Computer programs were written to study the variations of the different parameters and to enable preliminary design when tolerances are attributed to the trouble making sources. It was found that the responses due to configurational asymmetries cannot be generally used to predict maximum responses due to inertial asymmetries. Similarly, the responses for the increasing roll rate cases cannot generally be used for the decreasing roll rate cases. Author

N75-32022*# Avco Corp., Wilmington, Mass. Systems Div.
ANALYSIS OF HELICOPTER ROTOR BLADE TORSIONAL OSCILLATIONS DUE TO STALL Final Report
Peter Crimi Washington NASA Sep. 1975 56 p refs
(Contract NAS1-12853)
(NASA-CR-2573) Avail: NTIS HC $4.25 CSCL 01A

An analysis of stall-induced helicopter rotor blade torsional oscillations was carried out, the primary objectives being to predict the onset and severity of the oscillations and their relationship to aircraft and blade parameters. Blade flapping, flapwise bending, and torsional degrees of freedom were taken into account, with radial variation in aerodynamic loading determined from a previously developed dynamic stall model. Results of analyses were compared with data from flight tests of helicopters. Analyses were carried out while parametrically varying blade vibrational characteristics. It was found that the amplitudes of the higher harmonics of torsional oscillations can be significantly reduced by either reducing the torsional natural frequency or introducing viscous damping in the torsional degree of freedom. A preliminary investigation was conducted to determine the feasibility and practicality of alleviating the stall problem by means of boundary layer control. The results indicate that boundary layer control would be effective in reducing the higher harmonics of torsional oscillations due to stall and that its implementation would not require excessive power or suction rates. Author

N75-32023*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC AERODYNAMIC CHARACTERISTICS OF INTERACTING LIFTING SURFACES WITH SEPARATED FLOW AROUND SHARP EDGES PREDICTED BY A VORTEX-LATTICE METHOD
John E. Lamar and Blair B. Gloss Washington Sep. 1975 92 p
(NASA-TN-D-7921; L-10001) Avail: NTIS HC $4.75 CSCL 01A

Because the potential flow suction along the leading and side edges of a planform can be used to determine both leading- and side-edge vortex lift, the present investigation was undertaken to apply the vortex-lattice method to computing side-edge suction force for isolated or interacting planforms. Although there is a small effect of bound vortex sweep on the computation of the side-edge suction force, the results obtained for a number of different isolated planforms produced acceptable agreement with results obtained from a method employing continuous induced-velocity distributions. By using the method outlined, better agreement between theory and experiment was noted for a wing in the presence of a canard than was previously obtained.
Author

N75-32024*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POTENTIAL AND VISCOUS FLOW IN VTOL, STOL OR CTOL PROPULSION SYSTEM INLETS
Norbert O. Stockman 1975 20 p refs Presented at the Eleventh Propulsion Conf., Anaheim, Calif., 29 Sep. - 1 Oct. 1975; cosponsored by AIAA and SAE
(NASA-TM-X-71799) Avail: NTIS HC $3.25 CSCL 01A

A method was developed for analyzing the flow in subsonic axisymmetric inlets at arbitrary conditions of freestream velocity, incidence angle, and inlet mass flow. An improved version of the method is discussed and comparisons of results obtained with the original and improved methods are given. Comparisons with experiments are also presented for several inlet configurations and for various conditions of the boundary layer from insignificant to separated. Applications of the method are discussed, with several examples given for specific cases involving inlets for VTOL lift fans and for STOL engine nacelles. Author

N75-32025*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A STATIC AIR FLOW VISUALIZATION METHOD TO OBTAIN A TIME HISTORY OF THE LIFT-INDUCED VORTEX AND CIRCULATION
James C. Patterson, Jr. and Frank L. Jordan, Jr. Sep. 1975 11 p ref
(NASA-TM-X-72769) Avail: NTIS HC $3.25 CSCL 01A

A recently proposed method of flow visualization was investigated at the National Aeronautics and Space Administration's Langley Research Center. This method of flow visualization is particularly applicable to the study of lift-induced wing tip vortices through which it is possible to record the entire life span of the vortex. To accomplish this, a vertical screen of smoke was produced perpendicular to the flight path and allowed to become stationary. A model was then driven through the screen of smoke producing the circular vortex motion made visible as the smoke was induced along the path taken by the flow and was recorded by highspeed motion pictures. Author

N75-32026*# Boeing Commercial Airplane Co., Seattle, Wash.
A THREE-DIMENSIONAL SOLUTION OF FLOWS OVER WINGS WITH LEADING-EDGE VORTEX SEPARATION. PART 1: ENGINEERING DOCUMENT
Guenter W. Brune, James A. Weber, Forrester T. Johnson, Paul Lu, and Paul E. Rubbert Sep. 1975 98 p refs
(Contracts NAS1-12185; BAS1-13833)
(NASA-CR-132709; D6-41789-Pt-1) Avail: NTIS HC $4.75 CSCL 01A

A method of predicting forces, moments, and detailed surface pressures on thin, sharp-edged wings with leading-edge vortex separation in incompressible flow is presented. The method employs an inviscid flow model in which the wing and the rolled-up vortex sheets are represented by piecewise, continuous quadratic doublet sheet distributions. The Kutta condition is imposed on all wing edges. Computed results are compared with experimental data and with the predictions of the leading-edge suction analogy for a selected number of wing planforms over a wide range of angle of attack. These comparisons show the method to be very promising, capable of producing not only force predictions, but also accurate predictions of detailed surface pressure distributions, loads, and moments. Author

N75-32027*# Boeing Commercial Airplane Co., Seattle, Wash.
A THREE-DIMENSIONAL SOLUTION OF FLOWS OVER WINGS WITH LEADING-EDGE VORTEX SEPARATION. PART 2: PROGRAM DESCRIPTION DOCUMENT
Ronald G. Coleman, Forrester T. Johnson, and Paul Lu Sep. 1975 186 p refs
(Contracts NAS1-12185; NAS1-13833)
(NASA-CR-132710; D6-41789-Pt-2) Avail: NTIS HC $7.00 CSCL 01A

For abstract, see N75-32026.

N75-32028*# Auburn Univ., Ala. Dept. of Aerospace Engineering.
ANALYSIS AND COMPILATION OF MISSILE AERODYNAMIC DATA, VOLUME 1 Final Report
James O. Nichols 30 Jun. 1975 116 p
(Grant NsG-1002)
(NASA-CR-119142) Avail: NTIS HC $5.25 CSCL 16D

Summaries of missile aerodynamic data are presented. Most of the configurations considered are suitable for highly maneuverable air-to-air or surface-to-air missiles; data for a few air-to-surface, cruise missile, and one projectile configuration are also presented. The Mach number range of the data is from about 0.2 to 4.63; however, data for most configurations cover only a portion of this range. The following aerodynamic characteristics at various Mach numbers and zero angle of attack are presented: (1) base drag coefficient, (2) drag coefficient, (3) lift-curve slope, (4) aerodynamic-center location, (5) sideslip derivatives, and (6) control effectiveness. The maximum lift-drag ratio is also presented for some configurations. Author

N75-32029*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FIRE SAFETY EVALUATION OF AIRCRAFT LAVATORY AND CARGO COMPARTMENTS
D. A. Kourtides, J. A. Parker, C. J. Hilado (San Francisco Univ., Calif.), R. A. Anderson (Boeing Com. Airplane Co., Seattle Wash.), E. Tustin (Boeing Com. Airplane Co., Seattle Wash.), D. E. Arnold (Boeing Com. Airplane Co., Seattle Wash.), J. G. Gaume (McDonnell-Douglas Corp., Long Beach, Calif.), A. T. Binding (McDonnell-Douglas Corp., Long Beach, Calif.), and J. L. Mikeska (McDonnell-Douglas Corp., Long Beach, Calif.) Aug. 1975 56 p refs
(NASA-TM-X-62471; A-6235) Avail: NTIS HC $4.25 CSCL 01C

Large-scale aircraft lavatory and cargo compartment fire tests are described. Tests were conducted to evaluate the effectiveness of these compartments to contain fire and smoke. Two tests were conducted and are detailed. Test 1 involved a production Boeing 747 lavatory of the latest design installed in an enclosure outside the aircraft, to collect gases and expose animals to these gases. Results indicate that the interior of the lavatory was completely burned, evolving smoke and combustion products in the enclosure. Test 2 involved a simulated Douglas DC-10 cargo compartment retro-fitted with standard fiberglass liner. The fire caused excessive damage to the liner and burned through the ceiling in two areas. Test objectives, methods, materials, and results are presented and discussed. Author

N75-32030*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRAIN-GAGE BRIDGE CALIBRATION AND FLIGHT LOADS MEASUREMENTS ON A LOW-ASPECT-RATIO THIN WING
Ellwood L. Peele and Clinton V. Eckstrom Washington Oct. 1975 55 p refs
(NASA-TN-D-7979; L-9896) Avail: NTIS HC $4.25 CSCL 01D

Strain-gage bridges were used to make in-flight measurements of bending moment, shear, and torque loads on a low-aspect-ratio, thin, swept wing having a full depth honeycomb sandwich type structure. Standard regression analysis techniques were employed in the calibration of the strain bridges. Comparison of the measured loads with theoretical loads are included. Author

N75-32031*# Case Western Reserve Univ., Cleveland, Ohio.
CONTROL OF SHOCK WAVE-BOUNDARY LAYER INTERACTIONS BY BLEED IN SUPERSONIC MIXED COMPRESSION INLETS Final Report
Michael K. Fukuda, Warren G. Hingst, and Eli Reshotko Washington NASA Aug. 1975 143 p refs
(Grant NGL-36-027-038)
(NASA-CR-2595; FTAS/TR-75-100) Avail: NTIS HC $5.75 CSCL 01A

An experimental investigation was conducted to determine the effect of bleed on a shock wave-boundary layer interaction in an axisymmetric mixed-compression supersonic inlet. The inlet was designed for a free-stream Mach number of 2.50 with 60-percent supersonic internal area contraction. The experiment was conducted in the NASA Lewis Research Center 10-Foot Supersonic Wind Tunnel. The effects of bleed amount and bleed geometry on the boundary layer after a shock wave-boundary layer interaction were studied. The effect of bleed on the transformed form factor is such that the full realizable reduction is obtained by bleeding of a mass flow equal to about one-half of the incident boundary layer mass flow. More bleeding does not yield further reduction. Bleeding upstream or downstream of the shock-induced pressure rise is preferable to bleeding across the shock-induced pressure rise. Author

N75-32032*# Goodyear Aerospace Corp., Akron, Ohio.
FEASIBILITY STUDY OF MODERN AIRSHIPS, PHASE 1. VOLUME 1: SUMMARY AND MISSION ANALYSIS (TASKS 2 AND 4) Final Technical Report, 9 Dec. 1974 - 9 Apr. 1975
Fred Bloetscher Aug. 1975 141 p refs
(Contract NAS2-8643)
(NASA-CR-137692-Vol-1; GER-16146-Vol-1) Avail: NTIS HC $5.75 CSCL 01B

The histroy, potential mission application, and designs of lighter-than-air (LTA) vehicles are researched and evaluated. Missions are identified to which airship vehicles are potentially suited. Results of the mission analysis are combined with the findings of a parametric analysis to formulate the mission/vehicle combinations recommended for further study. Current transportation systems are surveyed and potential areas of competition are identified as well as potential missions resulting from limitations of these systems. Potential areas of military usage are included. Author

N75-32033*# Goodyear Aerospace Corp., Akron, Ohio.
FEASIBILITY STUDY OF MODERN AIRSHIPS, PHASE 1. VOLUME 2: PARAMETRIC ANALYSIS (TASK 3) Final Technical Report, 9 Dec. 1974 - 9 Apr. 1975
Jon W. Lancaster Aug. 1975 144 p refs
(Contract NAS2-8643)
(NASA-CR-137692-Vol-2; GER-16146-Vol-2) Avail: NTIS HC $5.75 CSCL 01B

Various types of lighter-than-air vehicles from fully buoyant to semibuoyant hybrids, were examined. Geometries were optimized for gross lifting capabilities for ellipsoidal airships, modified delta planform lifting bodies, and a short-haul, heavy-lift vehicle concept. It is indicated that: (1) neutrally buoyant airships employing a conservative update of materials and propulsion technology provide significant improvements in productivity; (2) propulsive lift for VTOL and aerodynamic lift for cruise significantly improve the productivity of low to medium gross weight ellipsoidal airships; and (3) the short-haul, heavy-lift vehicle, consisting of a simple combination of an ellipsoidal airship hull and existing helicopter componentry, provides significant potential for low-cost, near-term applications for ultra-heavy lift missions. Author

N75-32034*# Goodyear Aerospace Corp., Akron, Ohio.
FEASIBILITY STUDY OF MODERN AIRSHIPS, PHASE 1. VOLUME 3: HISTORICAL OVERVIEW (TASK 1) Final Technical Report, 9 Dec. 1974 - 9 Apr. 1975
Gerald L. Faurote Aug. 1975 158 p refs
(Contract NAS2-8643)
(NASA-CR-137692-Vol-3; GER-16146-Vol-3) Avail: NTIS HC $6.25 CSCL 01B

The history of lighter-than-air vehicles is reviewed in terms of providing a background for the mission analysis and parametric analysis tasks. Data from past airships and airship operations are presented in the following areas: (1) parameterization of design characteristics; (2) markets, missions, costs, and operating procedures, (3) indices of efficiency for comparison; (4) identification of critical design and operational characteristics; and (5) definition of the 1930 state-of-the-art and the 1974 state-of-the-art from a technical and economic standpoint. Author

N75-32035*# Goodyear Aerospace Corp., Akron, Ohio.
FEASIBILITY STUDY OF MODERN AIRSHIPS, PHASE 1. VOLUME 4: APPENDICES Final Technical Report, 9 Dec. 1974 - 9 Apr. 1975
Jon W. Lancaster Aug. 1975 224 p refs
(Contract NAS2-8643)
(NASA-CR-137692-Vol-4; GER-16146-Vol-4) Avail: NTIS HC $7.25 CSCL 01B

For abstract, see N75-32032.

N75-32036# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL STATIC STABILITY STUDIES OF SEVERAL TACTICAL MISSILE CONFIGURATIONS AT MACH NUMBERS FROM 1.76 TO 3.01 Final Report, 16 Aug. - 7 Sep. 1974
E. Earl Lindsay and J. L. Jordan AEDC Apr. 1975 113 p
(AF Proj. 9738)
(AD-A009137; ARO-VKF-TR-74-130) Avail: NTIS CSCL 16/4

An experimental investigation was conducted in the low supersonic Mach number regime to obtain generalized, systematic force and moment data on several tactical missile configurations. Aerodynamic characteristics were determined for a typical missile body and nine body-fin configurations. The aerodynamic loading on each fin was also obtained for the nine fin configurations in a cruciform arrangement at zero deflection. The test was conducted at Mach numbers of 1.76, 2.00, 2.50, and 3.01 and free-stream Reynolds numbers, based on model length, from 8.3 to 14.5 million. The angle-of-attack range was from -1 to 45 deg, and the roll angle range was from 0 to 90 deg. Results are presented to illustrate the effects of fin aspect ratio, planform shape, and planform area on the missile and fin aerodynamic characteristics. GRA

N75-32037*# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
CONVERGENCE ACCELERATION AND SHOCK FITTING FOR TRANSONIC AERODYNAMICS COMPUTATIONS
Mohamed M. Hafez and H. K. Cheng Apr. 1975 28 p refs

Sponsored by NASA
(Contracts N00014-75-C-0520; N00014-67-A-0269-0021; NR Proj. 061-192)
(NASA-CR-143502; AD-A009898; USCAE-132) Avail: NTIS HC $3.25 CSCL 20/4

The report presents a method to accelerate convergence of iterative solutions for elliptic and mixed-type partial differential equations. Part two presents shock-fitting method for the line-relaxation solutions to a transonic potential equation. Significant improvements over existing finite-difference methods in speed (economy) and in accuracy are demonstrated in the framework of transonic small-disturbance theory. GRA

N75-32038# Naval Surface Weapons Center, Dahlgren, Va.
MINIMIZATION OF LOCK-IN ROLL MOMENT ON MISSILES VIA SLOTS
P. Daniels Jan. 1975 107 p refs
(AD-A010130; NSWC/DL-TR-3250) Avail: NTIS CSCL 16/4

An experimental wind tunnel study was conducted to determine whether a method for minimizing the roll lock-in moment on cruciform fin configurations could be developed from analysis of the fin-pressure distribution. Pressure and force tests show that at subsonic speeds, outboard fin slots produce the greatest reduction in the roll lock-in moment throughout the angle of attack range. However, this reduction is not significantly greater than a central slot of the same area. GRA

N75-32039# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRODYNAMIC CHARACTERISTICS OF DELTA LOW ASPECT-RATIO CONFIGURATION WING NEAR SCREEN
A. G. Kostin 20 Dec. 1974 28 p refs Transl. into ENGLISH from Gidrodinamika Bolshikh Skorostei (USSR), no. 5, 1968 p 113-120
(AD-A002891; FTD-MT-24-217-75) Avail: NTIS CSCL 01/1

Starting with the one-dimensional integral equation of motion for the lifting surface of mean aspect ratio, the variational first approximation is derived for the ordinary differential of the second order of load distribution. The aerodynamic coefficients of the delta wing of low aspect ratio were found, and the effects of wing camber on it characteristics were investigated. It is concluded that with a decrease in the distance of the wing from the screen, the center of gravity shifts slightly to the trailing edge of the wing, and the greater the wing camber, the nearer the center of gravity to the wing tip. F.O.S.

N75-32040# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLOW OF SUPERSONIC FLOW ABOUT THE SPHERE OF IDEAL GAS
A. P. Bazzhin and V. I. Blagosklonov 18 Feb. 1975 24 p refs Transl. into ENGLISH from Tsentr. Aerogidrodinamicheskii Inst. Uch. Zap. (USSR), v. 2, no. 3, 1971 p 95-101
(AD-A006853; FTD-MT-24-0578-75) Avail: NTIS CSCL 20/4

The results are given of the numerical flow-field analysis of a sphere in a Mach number range of 1.5 to 1000 and specific heat ratios of the gas from 1.05 to 1.66. For a series of flows are given empirical similarity criteria which make it possible to present the results in analytical form. GRA

N75-32041# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VISCOSITY EFFECT ON DEPARTURE IMPACT BY BOLNY DURING THE FLOW OF HYPERSONIC FLOW ABOUT THE CYLINDER
Yu. N. Ermak and V. Ya. Neiland 24 Jan. 1975 24 p refs Transl. into ENGLISH from Tsentralnyi Aerogidrodinamicheskii Inst. Uchen. Zap. (USSR), v. 2, no. 6, 1971 p 41-47
(AD-A006561; FTD-MT-24-440-75) Avail: NTIS CSCL 20/4

The effect of viscosity and thermal conductivity on the departure of a shock wave from the surface of a circular cylinder during hypersonic flow is determined. The vortex/eddy interaction of the boundary layer with the inviscid shock layer is considered. Results are discussed. J.M.S.

N75-32002 Aerospace Research Labs., Wright-Patterson AFB, Ohio.
THEORETICAL MODEL FOR VISCOUS INTERACTIONS
Wilbur L. Hankey, Jr. *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in High Speed Flow Jun. 1975 p 2-13 (For availability see N75-32001 23-01)

N75-32003 Aerospace Research Labs., Wright-Patterson AFB, Ohio.
SPECIAL TOPICS
Wilbur L. Hankey, Jr. *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in High Speed Flows Jun. 1975 p 13-40 refs (For availability see N75-32001 23-01)

N75-32004 Calspan Corp., Buffalo, N.Y.
THE DEVELOPMENT OF MODELS OF SHOCK WAVE BOUNDARY LAYER INTERACTION
Michael S. Holden *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in High Speed Flow Jun. 1975 p 42-44 (For availability see N75-32001 23-01)

N75-32006 Calspan Corp., Buffalo, N.Y.
SHOCK WAVE-LAMINAR BOUNDARY LAYER INTERACTIONS
Michael S. Holden *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in High Speed Flows Jun. 1975 p 48-58 (For availability see N75-32001 23-01)

N75-32007 Calspan Corp., Buffalo, N.Y.
SHOCK WAVE-TURBULENT BOUNDARY LAYER INTERACTIONS
Michael S. Holden *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in High Speed Flows Jun. 1975 p 58-110 refs (For availability see N75-32001 23-01)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N75-32042*# Kanner (Leo) Associates, Redwood City, Calif.
OPERATIVE DISTURBANCE REPORTING FOR THE COMMERCIAL AIRPLANE
R. Axelsson Washington NASA Sep. 1975 53 p Transl. into ENGLISH from Swedish report TA-848-R1, 28 Feb. 1975 44 p
(Contract NASw-2790)
(NASA-TT-F-16549; TA-848-R1) Avail: NTIS HC $4.25 CSCL 17G

A preliminary investigation concerning disturbance reporting by taxiplane pilots is discussed. The efficiency of the reporting format used is examined. Data are provided to serve as a base from which to determine the frequency and types or disturbances and incidents occurring. Author

N75-32043# Army Materiel Command, Texarkana, Tex. Intern Training Center.
AIR BAG PROTECTION OF THE GUNNER IN THE US ARMY COBRA AH-1Q Final Report
Thomas M. Loushine Apr. 1975 62 p refs
(AD-A009421; USAMC-ITC-02-08-75-411) Avail: NTIS CSCL 01/3

The new version of the U.S. Army Cobra attack helicopter, the AH-1Q, makes use of a new rigid column sighting device. This rigid column introduces a serious hazard to the gunner who may come in contact with it during a crash. This report looks at the possibility of using an inflatable air bag to protect the gunner from sight inflicted injury. An overall description of the mechanics and reliability of the air bag, as found in present day automobiles, is included to give the reader a basic understanding of how air bags work. With this understanding, various considerations are made as to how an air bag system, similar to an automobile air bag system, could be designed into the gunner position of the AH-1Q. GRA

N75-32044# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORT. BRIEF FORMAT: U.S. CIVIL AVIATION ISSUE NO. 4 OF 1974 ACCIDENTS. FILE NUMBERS: 1-0001, 1-0032 THRU 1-0035, 1-0037 THRU 1-0038, 3-0001, 3-0188, 3-2701 THRU 3-2978, 3-2980 THRU 3-3038, 3-3040 THRU 3-3600
14 Mar. 1975 511 p refs
(PB-241542/0; NTSB-BA-75-1) Avail: NTIS HC $12.25 CSCL 01B

The publication contains selected aircraft accident reports, in brief format, occurring in U.S. civil aviation operations during calendar year 1974. The 900 general aviation and 7 air carrier accidents represent a random selection. This publication is issued irregularly, normally six times each year. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. GRA

N75-32045# Army Aeromedical Research Lab., Fort Rucker, Ala.
A CROSS-VALIDATION STUDY OF THE PERSONALITY ASPECTS OF INVOLVEMENT IN PILOT-ERROR ACCIDENTS
Michael G. Sanders, Mark A. Hofmann, and Thomas A. Neese Mar. 1975 19 p refs
(DA Proj. 3A0-61101-A-91C)
(AD-A010352; USAARL-75-15; USAAAVS-TR-75-3) Avail: NTIS CSCL 01/2

Pilot-error accidents have dominated accident statistics consistently from the 1940s to the present. Three factors in a personality factor questionnaire showed significant differences between pilot-error accident groups and were used to correctly classify 86% of aviators tested on their previous pilot-error accident involvement. Sixty-six aviators were tested in an attempt to cross-validate the findings reported in the original study. The findings indicate that individual differences in personality characteristics of the aviators hinder identification of traits associated with pilot-error groups. GRA

N75-32046# Army Electronics Labs., Fort Monmouth, N.J.
AN EXPERIMENTAL EVALUATION OF GATED LOW LIGHT TV(GL3TV) FOR WIRE OBSTACLE DETECTION Final Technical Report
A. Kleider May 1975 49 p refs
(DA Proj. 1F2-62202-AH-85)
(AD-A010331; ECOM-4321) Avail: NTIS CSCL 17/8

The problem of detecting wire obstacles constitutes a limiting factor in nighttime nap-of-the-earth helicopter operations. Several approaches to a solution for the problem are indicated and a detailed examination of the utilization of a Gated Low Light Level TV (GL3TV) is presented. The results of a limited pragmatic test program designed to explore the feasibility of this technique for wire obstacle detection are given. These results indicate that the technique is applicable to the problem provided means can be found to implement automatic acquisition and pattern recognition within a realistic cost. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N75-32047# Advisory Group for Aerospace Research and Development, Paris (France).
A SURVEY OF MODERN AIR TRAFFIC CONTROL, VOLUME 1
Andre Benoit, ed. Jul. 1975 400 p refs 2 Vol.
(AGARD-AG-209-Vol-1; AGARDograph-209-Vol-1) Avail: NTIS HC $10.25

Papers presented at the symposium are reported. Topics discussed include: general organization of ATC, human factors in ATC, and automation of control procedures. For individual titles, see N75-32048 through N75-32065.

N75-32048 Royal Radar Establishment, Malvern (England).
PRINCIPLES OF AIR TRAFFIC CONTROL
S. Ratcliffe *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 5-20 refs (For availability see N75-32047 23-04)

Air traffic control techniques are discussed along with the principles of traffic flow. Other topics discussed include: flight operations, terminal control, and organizational problems in an ATC sector. F.O.S.

N75-32049 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
ATC CONCEPTS
Horst A. Neumann *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 23-28 refs (For availability see N75-32047 23-04)

Ground based ATC procedures are discussed in terms of manual, electronic and structural air traffic control. F.O.S.

N75-32050 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
PRINCIPAL ATC COMPONENTS
Hans-George Friedrich *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 31-40 refs (For availability see N75-32047 23-04)

Functional descriptions are presented of ATC components. The systems described include navigation, surveillance, communications, and control centers. Author

N75-32051 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
THE CONTROLLER VERSUS AUTOMATION
V. David Hopkin *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 45-60 refs (For availability see N75-32047 23-04)

The relation of the controller to automation in air traffic control is discussed in terms of human factors engineering. Concepts discussed include: task changes and automation, workload, quality of navigation aid, training, potentially incompatible aims, effects of automation on task design, and automation and communication. F.O.S.

N75-32052 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
THE FUTURE POSITION OF THE CONTROLLER
Klaus Brauser and Ruediger Seifert *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 63-74 refs (For availability see N75-32047 23-04)

The problem of automation of ATC systems was shown to be a very complex task, concerning three different control loops with different characteristics but using the same data source. The different control loops were defined as executive (radar) control with the tasks of tactical intervention; planning control, with the tasks of procedural planning; and flow control. It was found that the human responsibility for air traffic safety cannot be delegated, but that there are many human activities which can be defined as black box actions performed more efficiently by computers. The resulting system is characterized as a highly effective human control system with an optimum amount of automatic devices to perform routine tasks as well as an effective decision aid with good on-line characteristics. Author

N75-32053 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
THE PSYCHOLOGIST'S VIEW
V. David Hopkin *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 77-102 refs (For availability see N75-32047 23-04)

The role of human factors in air traffic control depends on the stage at which it is first applied. The psychologist's contribution is most effective early in the system evolution, when

he can forestall problems as well as cure them. In studying air traffic control systems, ideally the psychologist uses system and job analysis, which he can both conduct and interpret. Aspects of the man-machine interface, such as displays, controls and communications, are optimized in relation to the efficiency and well-being of the men. His knowledge of differences between men is applied to recruitment, selection, training and screening. The effects of ageing and of experience are predicted from known progressive changes within each individual. Knowledge of the capabilities and tolerances of the man is used to solve problems of work-rest cycles, stress and workload. To solve these problems, the psychologist uses orthodox methods and specially devised techniques for assessing and measuring the man at work.
Author

N75-32054 Eurocontrol Agency, Brussels (Belgium).
MEDICAL PROBLEMS RELATING TO AIR TRAFFIC CONTROL PERSONNEL
E. Evrard *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 105-124 refs (For availability see N75-32047 23-04)

The protection of air traffic control personnel was studied. The following points were examined: (1) working conditions in the air traffic control services, flight information services and alerting services; (2) psychophysiological factors determining the efficiency of air traffic control systems; (3) occupational pathology of air traffic controllers, covering the problem of the danger of emission of X-rays by the cathode-ray tubes in the display screens, visual pathology, auditory pathology, and pathology caused by nervous tension; and (4) protection of air traffic control personnel.
Author

N75-32055 International Federation of Air Traffic Controllers Associations, Brussels (Belgium).
THE INTERNATIONAL FEDERATION OF AIR TRAFFIC CONTROLLERS ASSOCIATIONS (IFATCA)
T. H. Harrison *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 127-134 (For availability see N75-32047 23-04)

The IFATCA history is presented. The aims of the federation are discussed along with the annual conferences, and standing committees.
F.O.S.

N75-32056 Royal Radar Establishment, Malvern (England).
PRINCIPLES OF AUTOMATION IN AIR TRAFFIC CONTROL
S. Ratcliffe *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 141-156 refs (For availability see N75-32047 23-04)

The automation of ATC by reducing the data for processing by digital computer techniques was studied. Hardware and software reliability are discussed along with men and machines in ATC. Data sources for automated systems, and the use of computers in decision making are also discussed.
F.O.S.

N75-32057 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
DATA PROCESSING FOR ATC
Horst A. Neumann *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 159-172 refs (For availability see N75-32047 23-04)

There are two main objectives of data processing for air traffic control: first, support of tactical control by the provision of a sophisticated display of the air traffic situation and by the application of procedures of real-time conflict detection and solution; second, avoidance of air traffic congestion as well as reduction and balancing of the load of both the planning and the executive controller by automatic filtering of conflicts and by hierarchical structuring of planning and control functions. Features and criteria of functions termed flow planning, flow control and flight progress planning and control to achieve the second objective with the application of electronic data processing are considered.
Author

N75-32058 Sperry Rand Corp., St. Paul, Minn. Univac Defense Systems Div.
AUTOMATION IN AIR TRAFFIC CONTROL SYSTEMS
Adi J. Khambata *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 175-198 refs (For availability see N75-32047 23-04)

Controlling the ever-increasing number of aircraft movements in an orderly and safe manner in the nation's airspace is becoming a problem. The historical evolution is traced of Air Traffic Control (ATC) since before World War II. It also discusses the current ATC problems. The National Airspace System (NAS) design concept is presented, and the progress made in implementing it in the enroute area is described. The progress of automation in the terminal areas include systems such as the unique Common IFR Room at New York, one of the world's most congested metropolitan terminal areas, and the recently installed ARTS III System at O'Hare Field in Chicago, which is considered the world's busiest air terminal. Several other areas of automation, such as collision avoidance, which impact the ATC system, are also discussed.
Author

N75-32059 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CONFLICT AND COLLISION AVOIDANCE SYSTEMS
Roland Moreau *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 203-238 refs (For availability see N75-32047 23-04)

Greater flight safety dispite the growth in traffic by improved air traffic control was investigated. The means of ensuring greater safety for successive phases of a flight from takeoff to landing, airborne collision avoidance systems (CAS), and ATC/CAS compatibility are discussed.
F.O.S.

N75-32060 Mitre Corp., McLean, Va.
CONFLICT ALERT AND INTERMITTENT POSITIVE CONTROL
Lawrence G. Culhane and Barry M. Horowitz *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 241-256 refs (For availability see N75-32047 23-04)

Analytical, simulation and experimental results are presented which were obtained in the process of designing and progressing toward the implementation of ground-based collision avoidance systems for air traffic control. Selective subsystem performance criteria established as part of the design process are also presented. Different, but compatible system concepts are discussed. For situations involving IFR aircraft, a conflict alert capability will provide the controller with a displayed alert of impending situations of separation being less than minimums. An Intermittent Positive Control (IPC) function, utilizing data link and improved surveillance, provides an automated collision avoidance capability for VFR/VFR and VFR/IFR aircraft pairs, and provides an independent backup to the ATC system for IFR aircraft pairs. In addition, IPC includes pilot warning indications (PWI) for informing pilots of the location of proximate aircraft.
Author

N75-32061 Federal Aviation Administration, Washington, D.C.
AIR TRAFFIC FLOW CONTROL
Michael E. Perie, Juan F. Bellantoni, and Ian G. Wolf *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 261-278 refs (For availability see N75-32047 23-04)

The major operational problems in controlling the general flow of the nation's air traffic from a central facility are described, and some of the approaches that may be taken to help automate their solutions are outlined. The discussions are based on operational experience at the FAA's Air Traffic Control Systems Command Center and on the present prototype computer programs, developed by the Transportation Systems Center, that provide data processing support to the controllers at that facility. The operational problems, giving the history, present procedural techniques and constraints, data sources, and control strategies available are described. Some of the pitfalls in solving the operational problem. Various approaches to automating flow control such as quantifying the objectives and developing algorithms to assist the controllers are discussed.
Author

N75-32062 Stanford Research Inst., Menlo Park, Calif.
LOCAL AND REGIONAL FLOW METERING AND CONTROL
Robert S. Ratner, David K. Schmidt (Purdue Univ.), and Peter J. Wong *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 281-294 refs (For availability see N75-32047 23-04)

The safety and efficiency requirements for improving air traffic control were studied. Current sequencing and spacing operations in terminal areas are described along with local flow operations. F.O.S.

N75-32063 Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
APPLICATION OF MODERN CONTROL THEORY TO SCHEDULING AND PATH-STRETCHING MANEUVERS OF AIRCRAFT IN THE NEAR TERMINAL AREA
Michael Athans *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 297-322 refs (For availability see N75-32047 23-04)

A design concept is presented for the dynamic control of aircraft in the near terminal area. An arbitrary set of nominal air routes, with possible multiple merging points, all leading to a single runway is considered. The system allows for the automated determination of acceleration/deceleration of aircraft along the nominal air routes, as well as for the automated determination of path-stretching delay maneuvers. In addition to normal operating conditions the system accomodates variable commanded separations over the outer marker (to allow for takeoffs between successive landings); and emergency conditions (in the sense that an aircraft is given partial or complete priority for landing). The system design is based upon the combination of three distinct optimal control problems: (1) a standard linear-quadratic problem, (2) a parameter optimization problem, and (3) a minimum-time rendezvous problem. Simulation results involving twelve aircraft under both normal and emergency conditions are presented. Author

N75-32064 Eurocontrol Agency, Brussels (Belgium).
AIRCRAFT TRAJECTORY PREDICTION DATA FOR ATC PURPOSES
Andre Benoit and Eileen Evers (SCICON, Ltd., London) *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 327-367 refs (For availability see N75-32047 23-04)

A method is presented for assembling the aircraft trajectory data in a compact form which indicates the quality of the aircraft characteristic data produced. The main aspects are outlined of an EROCOA aircraft performance handbook which is being prepared. The method covers all phases of the flight with the exception of the takeoff and initial acceleration, final deceleration and landing. Climb, acceleration and deceleration at cruising level, cruise and descent are considered equally and data are assembled in order to compute the trajectory components during any of these phases. The data produced cover a fleet of over one hundred aircraft versions including sixty different aircraft types, namely most of the current commercial aircraft operating in Western Europe and manufactured in Europe of North America and a sample of aircraft specifically designed for military purposes. Author

N75-32065 Mitre Corp., McLean, Va.
NAVIGATION PERFORMANCE REQUIREMENTS FOR REDUCING ROUTE CENTERLINE SPACING
Ronald Braff *In* AGARD A Survey of Modern Air Traffic Control, Vol. 1 Jul. 1975 p 373-389 refs (For availability see N75-32047 23-04)

Several different studies have looked into the question of what can be done in the ATC system to enable the current route centerline spacing standard to be safely reduced. These studies include that of Boeing, The Royal Aircraft Establishment (RAE), Autonetics and MITRE. These four approaches to the problem of reducing route centerline spacing are summerized, and the results derived from each are compared. Author

N75-32066# Advisory Group for Aerospace Research and Development, Paris (France).
A SURVEY OF MODERN AIR TRAFFIC CONTROL. VOLUME 2
Andre Benoit, ed. Jul. 1975 336 p refs 2 Vol.
(AGARD-AG-209-Vol-2; AGARDograph-209-Vol-2) Avail: NTIS HC $9.50

Technical aids to air traffic control and operational air traffic control systems are discussed. Other topics discussed include principles of radiolocation, distance measuring methods, inertial navigation, landing guidance systems, digital radar data processing, computer use in air traffic control, satellite as an aid, TACAN, and omnidirectional radio beacons. For individual titles, see N75-32067 through N75-32082.

N75-32067 Standard Electrik Lorenz A.G., Stuttgart (West Germany).
PRINCIPLES OF RADIOLOCATION
W. Crone and G. Peuker *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 397-405 refs (For availability see N75-32066 23-04)

The basic principles of radio location are reviewed from the physical point of view; these include travel time, propagation time difference, phase difference, and amplitude. Properties of electromagnetic waves are summarized, and methods for error reduction are described with reference to errors generated by multipath propagation and reflection by obstacles. M.J.S.

N75-32068 Standard Electrik Lorenz A.G., Stuttgart (West Germany).
LONG DISTANCE AIDS (OMEGA, LORAN)
Walter Stanner *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 411-422 refs (For availability see N75-32066 23-04)

The ground-based long distance aids Omega and LORAN provide the user with position data by using the hyperbolic principle. Characteristics and equipment for the Omega, LORAN-A and LORAN-C systems are discussed. Author

N75-32069 Standard Electrik Lorenz A.G., Stuttgart (West Germany).
MEDIUM DISTANCE AIDS (VHF OMNIDIRECTIONAL RADIO BEACONS)
Guenter Hoefgen *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 425-433 refs (For availability see N75-32066 23-04)

VHF omnidirectional radio range (VOR) is a radio aid for aircraft guidance; it is an omnidirectional radio beacon providing the angle between aircraft and North, seen from the ground station. The VOR ground station radiates an azimuth-dependent signal which is analyzed as the bearing information by the aircraft receiver. The pilot guides the aircraft along the course selected with the aid of constant azimuth indication. The range is of the order of 100 to 150 nm. Author

N75-32070 Standard Electrik Lorenz A.G., Stuttgart (West Germany).
DISTANCE MEASURING METHODS
Manfred Boehm *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 437-446 (For availability see N75-32066 23-04)

The distance-measuring methods employing electromagnetic waves make use of the velocity of light; the path covered by a light or radio signal can be determined, if the transit time is known, from a formula. Round-trip and one-way distance measuring systems are described; the round-trip systems operate with responding transmitters (or with passive reflectors as in the case of radar or radio altimeters), and the responding transmitter will retransmit the received signal with an exactly defined delay. In the case of one-way distance-measuring systems, identical and extremely accurate time standards are used in both the transmitter and the receiver locations. Airborne and ground station equipment is discussed. Author

N75-32071 Standard Electrik Lorenz A.G., Stuttgart (West Germany).
TACAN
M. Boehm *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 449-455 refs (For availability see N75-32066 23-04)

Tactical air navigation (TACAN), a radio position-fixing method for military short and medium range aviation, is described. Each ground station currently provides azimuth or 'theta' values to any number of aircraft and distance or 'rho' values to maximum 120 aircraft at the same time. Both types of values are either directly displayed or are inputs for a navigation computer. Operational principles, airborne equipment, and TACAN ground stations are described in detail. Author

N75-32072 Ferranti, Ltd., Edinburgh (Scotland). Inertial Systems Dept.
INERTIAL NAVIGATION AND AIR TRAFFIC CONTROL
W. H. McKinlay *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 461-488 refs (For availability see N75-32066 23-04)

The history of the development of navigation within air traffic control systems is traced briefly, and the requirements for effective navigation and flight path control are discussed. They are related to the adoption of inertial navigation and to the possible future extention of its use. Typical airborne system configurations are described together with the facilities provided by them. Reference is made to systems for both civil and military aircraft. The principles of inertial navigation are described with a review of the standards of accuracy and reliability being achieved, and the technology involved. Author

N75-32073 Advisory Group for Aerospace Research and Development, Paris (France).
LANDING GUIDANCE SYSTEMS
Frank B. Brady *In its* A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 495-557 refs (For availability see N75-32066 23-04)

The evolution of aircraft landing guidance technology is reviewed, from rudimentary nondirectional beacons and markers in the 1920's through the development and installation of the current standard instrument landing system (ILS) and the microwave landing systems (MLS) proposed for future world standardization. The major milestones in landing guidance system development are depicted. Design considerations for MLS are discussed in detail. Author

N75-32074 Mitre Corp., Atlantic City, N.J.
DIGITAL RADAR DATA PROCESSING FOR ENROUTE AIR TRAFFIC CONTROL
John A. Varela *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 563-571 refs (For availability see N75-32066 23-04)

Digital radar data processing (RDP) in operation in twenty air route traffic control centers (ARTCCs) in the contiguous states are discussed. The system was extensively tested, its performance measured, and standards established for system performance. The functions of primary and secondary surveillance radar target detection, and the processing of target data in the central computer at the ARTCC are described. The latter includes filtering the data, conversion to common coordinates, correlation with automatic tracks, track smoothing and prediction in several modes, and measurement of data quality in real time. Data on measured system performance are given, and a short description of current efforts to improve system performance is included. Author

N75-32075 Eurocontrol Agency, Brussels (Belgium).
DISPLAY TECHNIQUES FOR AIR TRAFFIC CONTROL SYSTEMS
Richard Jenyns *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 577-604 refs (For availability see N75-32066 23-04)

The cathode ray tube is discussed which fulfills requirements for dynamic data displays in air traffic control systems. The basic principles of the cathode ray tube are described together with some recent developments which help to keep it in the forefront of display technology. Advanced techniques which emerged from research and development laboratories offer advantages not found with the cathode ray tube. The most promising of these techniques, which may find applications in air traffic control systems, are discussed together with their characteristics and relative merits. Author

N75-32076 Eurocontrol Agency, Brussels (Belgium).
USE OF COMPUTER IN AIR TRAFFIC CONTROL
B. Kirstetter, G. Maignan, and V. Vachiery *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 609-636 refs (For availability see N75-32066 23-04)

The characteristics and applications of computers in air traffic control, are discussed, mainly based on experience in the upper airspace. After a short summary of the different applications, the general characteristics of hardware and software architecture are discussed. This includes a description of multiprocessor and multicomputer systems with their specific ATC oriented peripherals, real-time operating systems, programming techniques, data base, and reliability aspects and the associated problems of recovery management. The principles of data transmission in air traffic control systems are included. Radar data processing deals mainly with mono- and multi-radar tracking aspects. A summary of the different functions is given which can presently be provided by a flight data processing system. Author

N75-32077 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
GENERAL ASPECTS OF DATA FLOW
Horst A. Neumann *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 639-645 refs (For availability see N75-32066 23-04)

Regarding complex systems such as air traffic control, data acquisition and data processing are performed through cooperation of man with machine. Indispensable dialog usually is accomplished by output of machine's results via teletypes, lineprinters, plotters, or luminous data displays and by input of man's acquired data, results, and decisions via functional keys, keyboards, and touch displays. A block diagram of data flow in air traffic control is presented. Manual data input is combined with data acquisition; data output is differentiated with respect to the receiver (pilot and controller). The diagram, as seen from a general point of view, represents implicitly all possible concepts of air traffic control executed on-ground, including even the concept of manual control, which leaves time-consuming tasks of data acquisition and preprocessing as well as all crucial tasks of intrinsic data processing to controllers. Author

N75-32078 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
SOME TRENDS IN HARDWARE CONCEPTS FOR ATC COMPUTER
Wolfgang Nittner *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 649-656 refs (For availability see N75-32066 23-04)

Four main requirements are discussed for hardware-structures resulting from applications such as radar data tracking, conflict detection and resolution, long-term flight plan coordination and flow control, flight progress adjustment, recording, and statistics application programs: reliability and safety, storage capacity and processing power, time behavior, and hardware-software-integration and software related features. Technologies and important features of computer structures are outlined. Author

N75-32079 Federal Aviation Administration, Washington, D.C. Aeronautical Satellite Div.
THE SATELLITE AS AN AID TO AIR TRAFFIC CONTROL
Keith D. McDonald *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 661-697 refs (For availability see N75-32066 23-04)

The capabilities and potential are discussed of satellite-based systems for navigation and air traffic control (ATC). The utility of satellite systems was extended from communications, surface navigation, and geodetic applications into air and space, and to other functional areas such as position surveillance for air traffic control, precise time and time transfer, international maritime and aeronautical position location and reporting services, and collision avoidance. A summary is presented of the basic principles upon which the satellite systems operate, along with an indication of their advantages and potential, a brief review of the historical developments, and a description of the system concepts and characteristics of selected satellite-based ATC systems. Author

N75-32080 Eurocontrol Agency, Brussels (Belgium).
EUROCONTROL DATA PROCESSING SYSTEMS
B. Kirstetter, G. Maignan, and V. Vachiery *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 703-724 (For availability see N75-32066 23-04)

The air traffic control data processing systems MADAP and KARLDAP, are designed for combined flight data and radar data processing. A description is given of the functions and hardware and software structure of the systems with special consideration

to reliability, programming, and implementation aspects. The radar data processing system SHANDAP is also described. Author

N75-32081 Rijksluchtvaartdienst, The Hague (Netherlands).
THE NETHERLANDS ATC AUTOMATION PROGRAM
J. S. Smit *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 727-734 (For availability see N75-32066 23-04)

A historical summary is presented of air traffic control radar data processing systems in use in the Netherlands. Operational characteristics and specifications are included. M.J.S.

N75-32082 Mitre Corp., McLean, Va.
OVERVIEW OF US AIR TRAFFIC CONTROL SYSTEM
Howard J. Kirshner *In* AGARD A Survey of Modern Air Traffic Control, Vol. 2 Jul. 1975 p 737-744 refs (For availability see N75-32066 23-04)

A brief overview is presented of the technical features of the systems used in U.S. air traffic control centers. Emphasis is placed on the recently modernized en route and terminal control systems. Author

N75-32083# Federal Aviation Administration, Washington, D.C.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN; PROGRAM STRUCTURE AND OBJECTIVES
Jul. 1975 43 p
(AD-A013351/2; FAA-ED-00-C; AEM-1) Avail: NTIS HC $3.75 CSCL 01/2

Program plans covering the present twenty-one engineering and development programs within the Federal Aviation Administration are discussed. The plans were required to provide more detailed information on the objectives, goals, program structure, technical approach, resources, possible implementation, and a number of other aspects for each of these programs. The planning process was formalized in order to provide a record of the status and availability of each plan. An introductory background to the planning process is presented and the objectives in each of the program areas, and an index of the plans are treated. Author

N75-32084*# California Univ., Berkeley. Institute of Transportation and Traffic Engineering.
MODELS FOR ESTIMATING RUNWAY LANDING CAPACITY WITH MICROWAVE LANDING SYSTEM (MLS)
Vojin Tosic and Robert Horonjeff Sep. 1975 204 p *refs*
(Grant NsG-2046)
(NASA-CR-137746) Avail: NTIS HC $7.25 CSCL 01E

A model is developed which is capable of computing the ultimate landing runway capacity, under ILS and MLS conditions, when aircraft population characteristics and air traffic control separation rules are given. This model can be applied in situations when only a horizontal separation between aircraft approaching a runway is allowed, as well as when both vertical and horizontal separations are possible. It is assumed that the system is free of errors, that is that aircraft arrive at specified points along the prescribed flight path precisely when the controllers intend for them to arrive at these points. Although in the real world there is no such thing as an error-free system, the assumption is adequate for a qualitative comparison of MLS with ILS. Results suggest that an increase in runway landing capacity, caused by introducing the MLS multiple approach paths, is to be expected only when an aircraft population consists of aircraft with significantly differing approach speeds and particularly in situations when vertical separation can be applied. Vertical separation can only be applied if one of the types of aircraft in the mix has a very steep descent angle. Author

N75-32085# Mitre Corp., McLean, Va.
A DESCRIPTION OF THE INTERMITTENT POSITIVE CONTROL CONCEPT
A. L. McFarland and B. M. Horowitz Jul. 1975 93 p refs Revised
(Contract DOT-FA70WA-2448)
(AD-776111/7; MTR-6587-Rev-1; FAA-EM-74-1) Avail: NTIS HC $4.25 CSCL 17/7

Intermittent positive control protection provided to pilots who are and are not operating under the control of the air traffic control system during uncontrolled flight is described. Intermittent positive control is a collision avoidance service provided by a totally automatic ground based system. Collision avoidance is achieved by continuously providing pilots with advisory information on the location of nearby aircraft and by issuing avoidance commands on an as needed basis. Equipment necessary to provide IPC, various services that are performed by the IPC system, and the processes by which the system determines its actions, are explained. Author

N75-32086# Naval Electronics Lab. Center, San Diego, Calif. Propagation Technology Div.
OMEGA PHASE ERROR MODEL ANALYSIS
C. P. Kugel 21 Mar. 1975 25 p refs
(AD-A010118; NELC-TD-421) Avail: NTIS CSCL 17/7

Several past and present efforts have been directed toward using models of expected Omega phase error behavior to simulate and assess the performance of navigation systems using Omega signals. The suggested models contain functional forms and parameters describing various possible components of the Omega phase error such as prediction bias, random variations, temporal and spatial correlation, and equipment errors. This document presents analyses of the various aspects of Omega phase errors and provides appropriate updates or modifications, as indicated by recent data, to the parameters and functional forms of the presently used models. Modeling aspects related to diurnal transition errors and to the performance of Relative Omega are also discussed. GRA

N75-32087# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EXPERIMENTAL VALIDATION OF PALM: A PRECISE AIRCRAFT LOCATION
J. E. Evans, D. Karp, R. R. LaFrey, R. J. McAulay, and I. G. Stiglitz 29 Apr. 1975 121 p refs
(Contracts F19628-73-C-0002; DOT-FA72WAI-242)
(AD-A010112; TN-1975-29; FSD-TR-75-166) Avail: NTIS CSCL 17/7

A ground based system to precisely locate aircraft in three dimensions based on transponder replies has been designed. Field tests have been conducted to validate the design of the elevation performance. This document reports on the principle of operation, experimental hardware and field test of the Precision Altitude and Landing Monitor (PALM). The key features incorporated in the PALM design include: (a) no new avionics required, i.e., uses standard aircraft transponder; (b) high accuracy position data, i.e., a 1-mrad (0.06 degrees) rms error in elevation and in azimuth; (c) broad airspace coverage, e.g., 40 degrees in elevation, 120 degrees in azimuth (expandable to 360 degrees) and several 10s of miles in range; and (d) low life cycle equipment cost. The high accuracy in the difficult airport multipath environment is a direct result of (a) a newly developed antenna synthesis procedure, (b) the development of adaptive multipath suppression techniques, and (c) the use of digital signal processing. The program, to date, has focused on an experimental evaluation of the elevation performance. The electronics required for the tests have been built into a self-powered van to facilitate experiments at remote airports. The actual flight test data demonstrated experimental errors on the order of 1 mrad; moreover, as predicted by theory, the resulting errors were essentially independent of elevation angle. Potential applications for the PALM position data include parallel approach monitoring, independent altitude monitoring, and/or performance assurance monitoring of landing guidance systems. GRA

N75-32088# Army Electronics Labs., Fort Monmouth, N.J. Avionics Lab.
AN ANALYSIS OF LORAN ERRORS FOR SIMULATION Final Report
Joseph A. Knight Mar. 1975 40 p refs
(Contract DAHC04-68-C-0011; DA Proj. 1F2-62202-AH-8504)
(AD-A007100; ECOM-4297) Avail: NTIS CSCL 17/7

The report discusses the modeling of a LORAN chain for purposes of simulation as a component subsystem within a hybrid navigation system. Three areas are treated: first, the basic principles and current operational practices of LORAN are reviewed; second, the basic error sources and limitations of LORAN are presented; and, third, a programmable error model is presented. The primary objective of the report is to evaluate the key error sources and identify causative mechanisms for those errors when LORAN is used as the position fix in the

augmentation of an inertial navigation system. The basic errors discussed are atmospheric noise, chain instability, geometric dilution, and receiver dynamics. The problem of propagation anomalies (warp) is discussed briefly but does not figure into this particular simulation context since insufficient statistical data exists for a proper model to be constructed and, in addition, the proposed hybrid system cannot compensate for this class of error input. These errors are then formulated in terms of error mechanisms easily programmable in ALGOL for implementation on the Burroughs B-5500 computer. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N75-32089# National Aerospace Lab., Tokyo (Japan).
SEMI-CONSTRAINED ATTITUDE CONTROL TESTS OF FLYING TEST BED FOR VTOL AIRCRAFT
Naoto Takizawa, Toshio Ogawa, Yoshikazu Tanabe, Akiyoshi Shibuya, Hirotoshi Fujieda, Tadao Kai, Yoshito Miyamoto, Koichi Ono, Tadao Torisaki, and Yoshio Goto Jan. 1975 55 p In JAPANESE; ENGLISH summary
(NAL-TR-402) Avail: NTIS HC $4.25

The semi-constrained attitude control tests are described of the flying test bed developed for the purpose of studying the problems associated with hovering as well as vertical takeoff and landing operations of VTOL aircraft. The FTB without landing gears was installed to a link mechanism which was designed to constrain the three linear movements, but to allow the three angular displacements. The attitude angles were constrained within + or - - 7.5 in roll, + or - 7.5 in pitch and + or 20 in yaw. The maximum angles and angular velocities which were recorded in the attitude control tests are as follows: 5, 4.1/S in roll and 4, 3.4/S in pitch for the remote control; 5.5, 6.3/S in roll, 4.5, 3.8/S in pitch and 10, 2.6/S in yaw for the pilot control. The attitude control tests showed that the attitude control system including the automatic stabilization equipment (ASE) provided good stability and control characteristics which are comparable to current helicopters and that the cancellation of engine gyroscopic moment by the ASE was satisfactory. The left yawing pedal effectiveness was better than that of right pedal because of engine rotation and of constrained reaction. Operating the ASE about the mechanically constrained axis caused to excite the FTB structural vibration. Author

N75-32090*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HYBRID UPPER SURFACE BLOWN FLAP PROPULSIVE-LIFT CONCEPT FOR THE QUIET SHORT-HAUL RESEARCH AIRCRAFT
John A. Cochrane and Robert J. Carros Sep. 1975 10 p refs
(NASA-TM-X-62477; A-6224) Avail: NTIS HC $3.25 CSCL 01C

The hybrid upper surface blowing concept consists of wing-mounted turbofan engines with a major portion of the fan exhaust directed over the wing upper surface to provide high levels of propulsive lift, but with a portion of the fan airflow directed over selected portions of the airframe to provide boundary layer control. NASA-sponsored preliminary design studies identified the hybrid upper surface blowing concept as the best propulsive lift concept to be applied to the Quiet Short-Haul Research Aircraft (QSRA) that is planned as a flight facility to conduct flight research at low noise levels high approach lift coefficients, and steep approaches. Data from NASA in-house and NASA-sponsored small and large-scale wind tunnel tests of various configurations using this concept are presented. Author

N75-32091*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MOTION-BASE SIMULATOR STUDY OF CONTROL OF AN EXTERNALLY BLOWN FLAP STOL TRANSPORT AIRCRAFT AFTER FAILURE OF AN OUTBOARD ENGINE DURING LANDING APPROACH
David B. Middleton, George J. Hurt, Jr., Hugh P. Bergeron, James M. Patton, Jr., Perry L. Deal, and Robert A. Champine Washington Oct. 1975 60 p refs
(NASA-TN-D-8026; L-9743) Avail: NTIS HC $4.25 CSCL 01C

A moving-base simulator investigation of the problems of recovery and landing of a STOL aircraft after failure of an outboard engine during final approach was made. The approaches were made at 75 knots along a 6 deg glide slope. The engine was failed at low altitude and the option to go around was not allowed. The aircraft was simulated with each of three control systems, and it had four high-bypass-ratio fan-jet engines exhausting against large triple-slotted wing flaps to produce additional lift. A virtual-image out-the-window television display of a simulated STOL airport was operating during part of the investigation. Also, a simple heads-up flight director display superimposed on the airport landing scene was used by the pilots to make some of the recoveries following an engine failure. The results of the study indicated that the variation in visual cues and/or motion cues had little effect on the outcome of a recovery, but they did have some effect on the pilot's response and control patterns. Author

N75-32092*# Kanner (Leo) Associates, Redwood City, Calif.
PERFORMANCE IMPROVEMENT THROUGH CONTROLLER-ASSISTED AIRCRAFT DESIGN
G. Loebert Washington NASA Sep. 1975 41 p refs Transl. into ENGLISH from Deut. Ges. fuer Luft- und Raumfahrt (Berlin), Oct. 1972 27 p
(Contract NASw-2790)
(NASA-TT-F-16551) Avail: NTIS HC $3.75 CSCL 01C

The possibility is demonstrated of obtaining high potential power increases at only small additional costs by employing artificial instead of natural stabilization. It is shown that if the requirement of static aerodynamic stability is eliminated the drag polars and thus the flight performances can be significantly improved. This improvement occurs mainly in the form of an increase in the specific power reserve at high lift coefficients and in an increase in the attainable maximum lift coefficients. The dynamic flight characteristics of such aircraft can be equal to or better than the characteristics of aerodynamically stable aircraft through an appropriate artificial stabilization. By incorporating suitable redundances and other provisions, the flight safety of conventional mechanically controlled aircraft can be achieved. Author

N75-32093*# United Air Lines, Inc., Denver, Colo.
ENGINEERING FLIGHT EVALUATION REPORT
John A. Morrison 26 Oct. 1973 73 p
(Contract NAS2-7208)
(NASA-CR-137755; ROT-75252) Avail: NTIS HC $4.25 CSCL 01C

The primary objective was to determine if the two-segment profile equipment, and operational procedures as defined by the B-727 Simulation Evaluation are operationally sound under all flight conditions expected to be encountered in line service. The evaluation was divided into the following areas: (1) to verify that the two-segment system operates as it was designed; (2) to conduct sufficient tests to secure a supplemental type certificate for line operation of the system; (3) to evaluate the normal operation of the equipment and procedures; (4) to evaluate the need for an autothrottle system for two-segment approaches; (5) to investigate abnormal operation of the equipment and procedures, including abused approaches and malfunctions of airborne and ground components; (6) to determine the accuracy and ease of flying the two-segment approach; (7) to determine the improvement in ground noise levels; and (8) to develop a guest pilot flight test syllabus. Author

N75-32094*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF RECENT DESIGN STUDIES OF ADVANCED ACOUSTIC-COMPOSITE NACELLES
Harry T. Norton, Jr. 10 Sep. 1975 15 p refs
(Contracts NAS1-13356; NAS1-13233)
(NASA-TM-X-72774) Avail: NTIS HC $3.25 CSCL 01C

The results are summarized of recent NASA-sponsored studies

of advanced acoustic-composite nacelles. Conceptual nacelle designs for current wide-bodied transports and for advanced technology transports, intended for operational use in the mid-1980's, were studied by Lockheed-California Company and the Douglas Aircraft Company. These studies were conducted with the objective of achieving significant reductions in community noise and/or fuel consumption with minimum penalties in airplane weights, cost, and operating expense. The results indicate that the use of advanced composite materials offer significant potential weight and cost savings and result in reduced fuel consumption and noise when applied to nacelles. The most promising concept for realizing all of these benefits was a long duct, mixed flow acoustic composite nacelle with advanced acoustic liners.

Author

N75-32095*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A MATHEMATICAL EXAMINATION OF THE PRESS MODEL FOR ATMOSPHERIC TURBULENCE

Kenneth Sidwell Washington Oct. 1975 66 p refs (NASA-TN-D-8038; L-10150) Avail: NTIS HC $4.25 CSCL 01C

The random process used to model atmospheric turbulence in aircraft response problems is examined. The first, second, and higher order probability density and characteristic functions were developed. The concepts of the Press model lead to an approximate procedure for the analysis of the response of linear dynamic systems to a class of non-Gaussian random processes. The Press model accounts for both the Gaussian and non-Gaussian forms of measured turbulence data. The nonstationary aspects of measured data are explicitly described by the transition properties of the random process. The effects of the distribution of the intensity process upon calculated exceedances are examined. It is concluded that the press model with a Gaussian intensity distribution gives a conservative prediction of limit load values.

Author

N75-32096# Advisory Group for Aerospace Research and Development, Paris (France).

FLUTTER SUPPRESSION AND STRUCTURAL LOAD ALLEVIATION

Jul. 1975 94 p refs In ENGLISH and partly in FRENCH Presented at the 40th meeting of the Struct. and Mater. Panel, Brussels, 13-18 Apr. 1975 (AGARD-CP-175) Avail: NTIS HC $4.75

Conference data on advances made in the area of flutter suppression and structrual load alleviation are summarized. Particular attention was given to system design, behavior, reliability, safety and redundancy, as found by analyses, model and flight tests. The use of active controls to suppress flutter was the dominant subject. The general problem was explored and specific examples and experiences were also presented. Flutter control of the wing/store combination, of the empannage and of a straight wing were studied, wind tunnel tests were discussed, automatic pilotage in turbulent air was examined and the mechanization of active controls was reviewed. For individual titles, see N75-32097 through N75-32104.

N75-32097 McDonnell Aircraft Co., St. Louis, Mo.

DESIGN CONSIDERATIONS FOR AN ACTIVE SUPPRESSION SYSTEM FOR FIGHTER WING/STORE FLUTTER

C. H. Perisho, W. E. Triplett, and W. J. Mykytow (AFFDL) *In* AGARD Flutter Suppression and Structural Load Alleviation Jul. 1975 19 p refs (For availability see N75-32096 23-05)

Results from a previous study on wing/store flutter are extended in a preliminary system design to determine realistic system integration features, and to provide a feasibility evaluation of a completely automatic, pilot-out-of-the-loop, adaptive active flutter control system which automatically adjusts a system gain and compensation for different stores on the aircraft. Information obtained included a definition of details involving hydraulic and structural modifications, hardware and software components, flight safety features, expected performance benefits and limitations, and program plans for a wind tunnel verification effort and subsequent flight test demonstrations.

Author

N75-32098 British Aircraft Corp., Filton (England). Commercial Aircraft Div.

ACTIVE FLUTTER SUPPRESSION

M. R. Turner *In* AGARD Flutter Suppression and Structural Load Alleviation Jul. 1975 14 p refs (For availability see N75-32096 23-05)

The use of Root-locus, Nyquist plots and state space theory in the design of active flutter suppression feedback laws is discussed. The concept of an optimum flutter suppression pole placement requirement is introduced. Description and examples are given of Dressler's and Kalman's dynamic observers for state space feedback when only one transducer is used. Examples are given of the effectiveness of feedback laws at off-design conditions for three different types of aircraft. The effect of aileron power control unit rate limit on the aileron control of hard flutter of a high aspect ratio wing in the presence of discrete and random gusts was shown. For a capability of 160 deg/sec., a 20 percent increase of flutter speed can be achieved with very large weight savings. The cutoff frequency usually quoted for the transfer function of power control units is shown to underestimate its flutter control capabilities. The possible need for feedback laws based upon flight test measurements is discussed.

Author

N75-32099 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

ACTIVE CONTROL OF EMPENNAGE FLUTTER

O. Sensburg, H. Hoenlinger, and M. Kuehn *In* AGARD Flutter Suppression and Structural Load Alleviation Jul. 1975 11 p refs (For availability see N75-32096 23-05)

After a successful application of the active flutter control technology on a wingstore flutter problem, an extension of this technology to an empennage flutter problem was considered. The task was to develop, build and test a control system which actively suppresses a total airplane model flutter problem by counteracting with a hydraulically driven rudder. The flutter phenomenon described is characterized by large contributions of fuselage torsional movement therefore producing high inertial forces in comparison with unsteady aerodynamic forces. These properties lead to a mild onset of flutter. For the same reason no rapid phase changes of the flutter mode near the flutter point are occurring.

Author

N75-32100 Boeing Co., Wichita, Kans.

WIND TUNNEL INVESTIGATION OF CONTROL CONFIGURED VEHICLE SYSTEMS

G. O. Thompson and F. D. Sevart *In* AGARD Flutter Suppression and Structural Load Alleviation Jul. 1975 8 p refs (For availability see N75-32096 23-05)

Research studies was conducted to demonstrate active flutter mode control and forward body ride control systems on a one-thirtieth scale B-52E aeroelastic model. The NASA model, originally designed and constructed for low speed gust response testing, was modified to represent the airplane used in the B-52 control configured vehicle (CCV) fight test program. The CCV program flutter mode control and vertical ride control systems were scaled to model frequency and tested in the transonic dynamics tunnel at conditions equivalent to airplane flight test conditions. Wind tunnel test results were compared with model analytical and airplane flight test results. The good correlation demonstrates wind tunnel test models can be employed to verify CCV system analysis and synthesis results, thus reducing risks involved in a new airplane development.

Author

N75-32101 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

CLOSED FORM EXPRESSION OF THE OPTIMAL CONTROL OF A RIGID AIRPLANE TO TURBULENCE

Gabriel Coupry *In* AGARD Flutter Suppression and Structural Load Alleviation Jul. 1975 8 p refs In FRENCH; ENGLISH summary (For availability see N75-32096 23-05)

An explanation is given as to how Wiener's theory makes it possible to derive in closed form, the transfer function of the filter used for control. It shows that this transfer function can be expressed in autoadaptative form, the poles being proportional to the velocity of the aircraft. The influence of parameters like mass, scale of turbulence, is discussed. Finally, a comparison is given between results of flight test and prediction.

Author

N75-32102 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
WIND TUNNEL TEST OF A FLUTTER SUPPRESSOR ON A STRAIGHT WING
Roger Destuynder *In* AGARD Flutter Suppression and Structural Load Alleviation Jul. 1975 3 p In FRENCH; ENGLISH summary (For availability see N75-32096 23-05)

A study was made of flutter due to a load hung under the wing of an aircraft. Special attention was given to aerodynamic and natural structural modes. Using an aerodynamically uncoupled control surface made it possible to simplify the transfer function of the servo-system. The control obtained this way is not optimal, but it does not require a precise knowledge of the aerodynamic forces and the wing dynamic characteristics, and provides an increased damping ratio in the whole velocity range. Author

N75-32103 Sperry Rand Corp., Phoenix, Ariz.
MECHANIZATION OF ACTIVE CONTROL SYSTEMS
James B. Flannigan and Thomas R. Elliott *In* AGARD Flutter Suppression and Structural Load Alleviation Jul. 1975 14 p refs (For availability see N75-32096 23-05)

Characteristics and limitations of current active control systems, in their ability to satisfy the requirements of more precise control of gain/phase relationships and flight safety implications, are discussed. Solutions to the potential shortcomings of these systems were also covered. Author

N75-32104 Hydraulic Research and Mfg. Co., Valencia, Calif.
HYDRAULIC CONTROLS FOR ACTIVE FLUTTER SUPPRESSION AND LOAD ALLEVIATION
Don A. Wiggins *In* AGARD Flutter Suppression and Structural Load Alleviation Jul. 1975 12 p refs (For availability see N75-32096 23-05)

A description is given of how system requirements influence the design and redundacy mechanizations of the hydraulic actuation portion of the flight control system. Some of the redundant hydraulic actuation concepts being used on advanced vehicles such as the NASA F-8 digital fly-by-wire aircraft and the space shuttle are discussed by examples. A summary is given of the present technology available in the field of redundant electrohydraulic actuation systems. Author

N75-32105# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
ARMY PRELIMINARY EVALUATION 1: MODEL 200 CEFLY LANCER Final Report, 20 Feb. - 6 Mar. 1974
George M. Yamakawa, Tom P. Benson, Larry K. Brewer, and Michael A. Hawley Jun. 1974 142 p refs
(AD-A009713; USAAEFA-74-21-1) Avail: NTIS CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted an Army Preliminary Evaluation of the Model 200 CEFLY LANCER aircraft, manufactured by Beech Aircraft Corporation, from 20 February to 6 March 1974 at the Beech facility in Wichita, Kansas. During the test program, 24.8 productive hours were flown. Performance, stability and control characteristics, and miscellaneous engineering tests were conducted. GRA

N75-32106# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
ARMY PRELIMINARY EVALUATION 2: MODEL 200 CEFLY LANCER Final Report, 27 Apr. - 15 May 1974
George M. Yamakawa, Tom P. Benson, and Larry K. Brewer Aug. 1974 78 p refs
(AD-A009714; USAAEFA-74-21-2) Avail: NTIS CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted Army Preliminary Evaluation (APE) 2 of the Model 200 CEFLY LANCER aircraft, manufactured by Beech Aircraft Corporation, from 27 April to 15 May 1974 at the Beech facility in Wichita, Kansas. During the test program, 7.3 productive hours were flown. Performance, stability and control characteristics, and miscellaneous engineering tests were conducted. GRA

N75-32107# McDonnell-Douglas Astronautics Co., St. Louis, Mo. Life Sciences Div.
IMPACT OF DESIGN TRADE STUDIES ON SYSTEM HUMAN RESOURCES Final Report, May 1973 - Jul. 1974
Gary V. Whalen and William B. Askren Dec. 1974 68 p refs
(Contract F33615-73-C-4150)
(AD-A009639; AFHRL-TR-74-89) Avail: NTIS CSCL 05/9

The study was undertaken to accomplish two objectives. The first objective was to identify and classify the characteristics of conceptual design trade studies that have high potential impact on human resource requirements of Air Force weapon systems. The approach used was a case history review and analysis of 129 F-15 aircraft design trade studies. The analysis indicated that the avionics system demonstrated the greatest potential impact on human resources. The types of human resources data (HRD) most influenced by alternative design options were maintenance task times and personnel costs. The second study objective was to determine the accuracy of using subjective estimates as a technique for deriving the HRD impact of trade study options. Using only engineering information for six avionics subsystems, from the conceptual design phase, Air Force maintenance technicians made subjective estimates of the impact of the designs on selected HRD items. It was found that technicians can make highly accurate estimates of the amount of time, the Air Force occupational specialty, the level of technical skill and the number of personnel needed to perform field maintenance tasks. GRA

N75-32108# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
ARTIFICIAL ICING TESTS AH-1G HELICOPTER Final Report, 22 Oct. 1973 - 2 Apr. 1974
Carl F. Mittag, Raymond B. Smith, Marvin L. Hanks, and James S. Reid Nov. 1974 94 p refs
(AD-A009712; USAAEFA-73-04-2) Avail: NTIS CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a limited in-flight artificial icing evaluation of the AH-1G helicopter from 22 October through 6 November 1973 at Fort Wainwright, Alaska, and from 22 March through 2 April 1974 in the vicinity of Moses Lake, Washington. During the test program 8.5 hours of productive flight time were flown, of which 4.0 hours were in the artificial icing environment. Three deficiencies were noted which adversely affect the safe operation of the AH-1G helicopter in an icing environment. GRA

N75-32109# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF A VARIATION-DIFFERENCE IN CALCULATIONS OF SHORT WING ASPECT RATIOS
T. G. Zuraev 27 Jan. 1975 23 p Transl. into ENGLISH from Tsentralnyi Aerogidrodinamicheskii Inst. Uchen. Zap. (USSR), v. 2, no. 4, 1971 p 90-95
(AD-A007102; FTD-MT-24-0467-75) Avail: NTIS CSCL 01/3

The application and use of a combined method for calculating short wing aspect ratios are reported. A structurally anisotropic plate is investigated as the analog of the aspect ratios. The possibilities and accuracy of the method are noted. GRA

N75-32110# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE OPTIMUM FORM OF LIFTING BODIES IN A HYPERSONIC FLOW
V. P. Kutukhin, L. D. Fedorova, and B. A. Elgudina 9 Jan. 1975 27 p refs Transl. into ENGLISH from Tsentr. Aerogidrodinamicheskii Inst. Uch. Zap. (USSR), v. 3, no. 3, 1972 p 100-106
(AD-A006832; FTD-MT-24-272-75) Avail: NTIS CSCL 20/4

The results are given of investigations of the optimum form of lifting bodies with predetermined geometric limitations - space, length, span. The pressure on the surface of the body was determined from Newton's formula, and friction was considered constant and independent of the form of body. GRA

N75-32111# Center for Naval Analyses, Arlington, Va. Operations Evaluation Group.
AN AIR COMBAT MANEUVER CONVERSION MODEL
Richard A. Oberle Nov. 1974 26 p refs
(Contract N00014-68-A-0091)
(AD-A010539; CRC-274) Avail: NTIS CSCL 15/7

A model that characterizes an air-to-air engagement as a semi-Markov process is described. Included is a discussion of the model's assumptions and effectiveness measures with instructions for applying the model to experiments characterizing

offensive and defensive maneuvering capability in air combat.
GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N75-32112*# Systems Control, Inc., Palo Alto, Calif.
INSTRUMENTATION REQUIREMENTS FOR AIRCRAFT PARAMETER IDENTIFICATION WITH APPLICATION TO THE HELICOPTER
J. A. Sorensen, R. L. Mohr, and T. B. Cline Jun. 1975 163 p refs
(Contract NAS1-12876)
(NASA-CR-132675) Avail: NTIS HC $6.25 CSCL 01D

The extent to which instrumentation errors cause degradation in the knowledge of stability and control derivatives identified for flight tests was studied along with the resultant degradation of the flight system performance base on these derivatives. The error in measurement and data processing systems used for parameter identification, error analysis techniques, and the effects of instrumentation, errors on the accuracy of parameter estimates are discussed. The analysis programs were used to study instrumentation error effects on the accuracy of the identified stability and control derivatives of the CH-46 helicopter. F.O.S.

N75-32113*# Systems Control, Inc., Palo Alto, Calif.
FLIGHT INSTRUMENTATION SPECIFICATION FOR PARAMETER IDENTIFICATION: PROGRAM USER'S GUIDE
R. L. Mohr Jun. 1975 134 p refs
(Contract NAS1-10791)
(NASA-CR-132676) Avail: NTIS HC $5.75 CSCL 01D

A set of four digital computer programs is presented which can be used to investigate the effects of instrumentation errors on the accuracy of aircraft and helicopter stability-and-control derivatives identified from flight test data. The programs assume that the differential equations of motion are linear and consist of small perturbations about a quasi-steady flight condition. It is also assumed that a Newton-Raphson optimization technique is used for identifying the estimates of the parameters. Flow charts and printouts are included. Author

N75-32114# Naval Electronics Lab. Center, San Diego, Calif.
A-7 ALOFT HARDWARE REQUIREMENTS ENVIRONMENTAL ANALYSIS Technical Document, Sep. - Oct. 1974
G. Holma 1 Apr. 1975 36 p refs
(AD-A009355/9; NELC/TD-418) Avail: NTIS HC $3.75 CSCL 09/1

Environmental and operational testing of a fiber-optic interface was conducted to determine suitability of fiber-optic cables, connectors, and LED module for use aboard the A-7 aircraft.
GRA

N75-32115# Sanders Associates, Inc., Nashua, N.H.
TACTILE DISPLAY FOR AIRCRAFT CONTROL Final Report, 1 Jul. 1972 - 15 Apr. 1975
Richard A. Sanneman 15 Apr. 1975 98 p refs
(Contract N00014-73-C-0031; DARPA Order 2108; NR Proj. 196-123)
(AD-A010258) Avail: NTIS CSCL 01/4

Nearly all flight parameter information is transmitted to the pilot visually and it is well known that instrument scanning during zero visibility flying conditions can be fatiguing. Displays using information from other modalities can alleviate the demands of this task and this program was directed towards the development of tactile displays for flight control. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N75-32116 Carnegie-Mellon Univ., Pittsburgh, Pa.
AN APPROXIMATE ANALYSIS OF THE EFFECT OF SECONDARY FLOWS ON THE MOTION OF PARTICULATES IN AN AXIAL FLOW GAS TURBINE Ph.D. Thesis
Asim Ulke 1975 166 p
Avail: Univ. Microfilms Order No. 75-19863

Small particles expected to enter the turbines of a coal-fired power plant were studied. Analytical models were developed for the important secondary flows, namely, the cascade secondary flow (the passage vortex), the radial flows, the blade wake flows and the end-wall boundary layers. The analysis was applied to the first stage of a typical gas turbine. A qualitative assessment of the blade erosion was made. It is possible to identify the general trends causing the high and the low erosion areas on the blade surfaces by isolating the effects of the blade geometry, the primary flow and the secondary flows on the particle motion. The importance of the amount of turning of the gas flow through the blade channels on the particle concentration is discussed. The further concentration of these particles by the passage vortices and the radial flows near the inner walls (hub walls) of the blade passages is found to be responsible for the critically heavy erosion of the rotor blade roots. Dissert. Abstr.

N75-32117*# Santa Clara Univ., Calif.
PRELIMINARY CORE-ENGINE NOISE ABATEMENT EXPERIMENTAL RESULTS OF A FLUID INJECTION NOZZLE ON A JT-15D TURBOFAN ENGINE
Dah Yu Cheng and Peter Wang 24 Sep. 1975 41 p refs
(Grant NGR-05-017-033)
(NASA-CR-137744) Avail: NTIS HC $3.75 CSCL 21E

Jet noise, as induced by shear stress, in an jet exhaust is investigated. Experiments were performed on a JT-15D fan jet to verify the inward momentum stress reduction concept. The experiments involved making fan air flow convergently around the high velocity core jet with a small angle. Ring airfoils were used as flow separators for the minimization of the thrust loss. Jet exhaust noise reduction of 11 db at 30 deg from the jet axis was recorded and 8 db integrated overall noise reduction over a hemisphere was measured with only 4.6% thrust loss, or 152 db/percent thrust loss. Author

N75-32118*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORTRAN PROGRAM FOR PREDICTING OFF-DESIGN PERFORMANCE OF RADIAL-INFLOW TURBINES
Charles A. Wasserbauer and Arthur J. Glassman Washington Sep. 1975 55 p refs
(NASA-TN-D-8063; E-8368) Avail: NTIS HC $4.25 CSCL 21E

The FORTRAN IV program uses a one-dimensional solution of flow conditions through the turbine along the mean streamline. The program inputs needed are the design-point requirements and turbine geometry. The output includes performance and velocity-diagram parameters over a range of speed and pressure ratio. Computed performance is compared with the experimental data from two radial-inflow turbines and with the performance calculated by a previous computer program. The flow equations, program listing, and input and output for a sample problem are given. Author

N75-32119*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
REVIEW OF AIRCRAFT NOISE PROPAGATION
Terrill W. Putnam Sep. 1975 61 p refs
(NASA-TM-X-56033) Avail: NTIS HC $4.25 CSCL 20A

The current state of knowledge about the propagation of aircraft noise was reviewed. The literature on the subject is

surveyed and methods for predicting the most important and best understood propagation effects are presented. Available empirical data are examined and the data's general validity is assessed. The methods used to determine the loss of acoustic energy due to uniform spherical spreading, absorption in a homogeneous atmosphere, and absorption due to ground cover are presented. A procedure for determining ground induced absorption as a function of elevation angle between source and receiver is recommended. Other factors that affect propagation, such as refraction and scattering due to turbulence, which were found to be less important for predicting the propagation of aircraft noise, are also evaluated. Author

N75-32120*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT ON FUEL PROPERTIES OF PERFORMANCE OF A SINGLE AIRCRAFT TURBOJET COMBUSTOR
Helmut F. Butze and Robert C. Ehlers 1975 16 p refs Presented at Fall Meeting of the Western States Section of the Combust. Inst., Palo Alto, Calif., 20-21 Oct. 1975
(NASA-TM-X-71789; E-8454) Avail: NTIS HC $3.25 CSCL 21E

The performance of a single-can JT8D combustor was investigated with a number of fuels exhibiting wide variations in chemical composition and volatility. Performance parameters investigated were combustion efficiency, emissions of CO, unburned hydrocarbons and NOx, as well as liner temperatures and smoke. At the simulated idle condition no significant differences in performance were observed. At cruise, liner temperatures and smoke increased sharply with decreasing hydrogen content of the fuel. No significant differences were observed in the performance of an oil-shale derived JP-5 and a petroleum-based Jet A fuel except for emissions of NOx which were higher with the oil-shale JP-5. The difference is attributed to the higher concentration of fuel-bound nitrogen in the oil-shale JP-5. Author

N75-32121*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
OPTIMIZATION AND SENSITIVITY STUDIES OF FLIGHT-PATH TRAJECTORIES Final Report
Gerald Cook and Richard M. Witt Sep. 1975 54 p refs
(Grant NsG-1101)
(NASA-CR-119132; EE-4038-102-75) Avail: NTIS HC $4.25 CSCL 20A

The optimization of landing trajectories of the Boeing 737 is presented. The primary factor considered was the noise delivered to the population residing near an air terminal but passenger comfort, fuel consumption and time elapsed during the maneuver were also considered. A digital simulation of the aircraft, a noise model and a passenger comfort model, was completed. The digital simulation was made more efficient time-wise. A population model for an urban area was developed and the noise model was integrated into the population model. A steepest descent optimization algorithm was programmed. Some constant glide slope trajectories into an urban Airport were simulated and evaluated with respect to the performance index, and their ground track plotted. Author

N75-32122# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CORE ENGINE NOISE CONTROL PROGRAM. VOLUME 1: IDENTIFICATION OF COMPONENT NOISE SOURCES Final Report, Jul. 1972 - Apr. 1974
K. R. Bilwakesh, V. G. Harris, S. B. Kazin, D. Latham, R. K. Matta, H. Morozumi, R. E. Motsinger, and H. D. Sowers Aug. 1974 109 p refs
(Contract DOT-FA72WA-3023)
(AD-A013128/4; FAA-RD-74-125-Vol-1) Avail: NTIS HC $5.25 CSCL 21/5

Various noise sources constituting the core engine noise for turbofan engines were identified and rank ordered. An investigation was made to ascertain the generating mechanisms, controlling variables, means of identification, and the effect on engine design if reduction were required for each of eight core engine noise sources. The relative significance of the various noise sources was evaluated by predicting the noise contribution of the individual components. The predictions were made for each of the three hypothetical cycles for bypass ratios of 4, 7, and 14, respectively, which were formulated to encompass a range of commercial aircraft powerplants. It was determined that combustor noise, jet noise, turbine and turbine jet interaction noise and obstruction noise would constitute the major noise sources, while casing radiation and compressor noise would act as secondary sources. Author

N75-32123# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CORE ENGINE NOISE CONTROL PROGRAM. VOLUME 2: IDENTIFICATION OF NOISE GENERATION AND SUPPRESSION MECHANISMS Final Report, Jul. 1972 - Apr. 1974
K. R. Bilwakesh, W. S. Clapper, J. J. Emmerling, S. B. Kazin, P. R. Knott, D. Latham, R. K. Matta, and H. Morozumi Aug. 1974 504 p refs
(Contract DOT-FA72WA-3023)
(AD-A013129/2; FAA-RD-74-125-Vol-2) Avail: NTIS HC $12.25 CSCL 21/5

The mechanisms of noise generation and suppression for the various core engine noise sources in turbofans were defined through a balanced analytical and experimental program. Model, component, and engine tests were used to substantiate the results of the analysis and to determine the basic noise generating parameters. The results were cast in a general form so as to be applicable to a wide variety of cycles, including future technology turbofan engines. Several suppression concepts were identified through analysis and through logical extension of experience with earlier programs on high velocity jet noise and fan/compressor noise research. The suppression concepts were validated through model and component tests and through evaluation of available engine data. Author

N75-32124# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CORE ENGINE NOISE CONTROL PROGRAM. VOLUME 3: PREDICTION METHODS Final Report, Jul. 1972 - Apr. 1974
K. R. Bilwakesh, J. J. Emmerling, S. B. Kazin, D. Latham, R. K. Matta, and H. Morozumi Aug. 1974 165 p refs
(Contract DOT-FA72WA-3023)
(AD-A013131/8; FAA-RD-74-125-Vol-3) Avail: NTIS HC $7.00 CSCL 21/5

Prediction methods for core engine noise were reviewed and either updated or new noise evaluation techniques formulated for low velocity coannular jets, combustors ("core" noise), low pressure turbines, interaction between turbine tones and fan/core jet streams, obstructions in the flow passages, and casing radiation. The development was based, to a large extent, on the analytical investigation and the model, component, and engine tests. The results were cast in a general form, so as to be applicable to a wide variety of cycles, including present and future turbofan engines. The prediction methods were validated with measured acoustic data wherever possible. Author

N75-32125*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF A 180 DEG-EXTENT INLET PRESSURE DISTORTION ON THE INTERNAL FLOW CONDITIONS OF A TF30-P-3
Claude E. DeBogdan, John H. Dicus, David G. Evans, and Ronald H. Soeder Washington Sep. 1975 63 p refs
(NASA-TM-X-3267; E-8206) Avail: NTIS HC $4.25 CSCL 21E

The measured effects of inlet pressure distortion on the internal flow temperatures and pressures of a TF30-P-3 afterburning turbofan engine are reported. Extensive inner-stage instrumentation combined with stepwise rotation of pressure distortion provided a high degree of circumferential resolution in the data. The steady-state spatial variation in pressures, temperature, and calculated flow velocity and the amplitude and extent of the distorted sectors are given. Data are presented for runs of 77 and 90 percent of low-speed-rotor design speed at pressure distortion levels two-thirds of that required to stall the engine. These data are compared with data taken at clean-inlet conditions. Results indicate that the inlet pressure distortion was quickly attenuated within the compressor, except at the hub of the low-pressure compressor. The distorted sectors also swirled and

varied in extent as they passed through the engine. Average velocities within the compressor were about equal to the clean-inlet values. Author

N75-32126*# General Electric Co., Evendale, Ohio.
NASA/NAVY LIFE/CRUISE FAN PRELIMINARY DESIGN REPORT
Jul. 1975 180 p refs
(Contract NAS3-19411)
(NASA-CR-134837; R75AEG414) Avail: NTIS HC $7.00 CSCL 21E

Preliminary design studies were performed to define a turbotip lift/cruise fan propulsion system for a Navy multimission aircraft. The fan is driven by the exhausts of the YJ97-GE-100 turbojet or a 20 percent Growth J97 configuration as defined during the studies. The LCF459 fan configuration defined has a tip diameter of 1.50 meters (59.0 inches) and develops a design point thrust of 75,130 N (16,890 lbs) at a fan pressure ratio of 1.319. The fan has an estimated weight of 386 kg (850 lbs). Trade studies performed to define the selected configuration are described. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N75-32127# National Aerospace Lab., Tokyo (Japan).
DETERMINATION OF LONGITUDINAL STABILITY AND CONTROL DERIVATIVES OF THE QUEEN AIR
Mikihiko Mori, Mitsuyoshi Mayanagi, Takyuki Nagoshi, Yoshio Goto, and Yushi Osterui Feb. 1975 31 p refs In JAPANESE; ENGLISH summary
(NAL-TR-406) Avail: NTIS HC $3.75

The longitudinal stability and control derivatives of the Beechcraft Queen Air-Model 65 were determined from the flight data for landing and cruising flight configurations. The result will be used for designing an automatic landing system for the airplane. To analyze the flight data, the least square method of conventional derivative type was adopted. The raw estimates of derivatives with considerable variations depending upon the sampling intervals, were shown. The final value of each derivative was determined by a simulated computation, and was compared with the wind tunnel test data. The accuracy of the derivatives is estimated to be of about 50 percent error for stability derivatives and less than 30 percent for control derivatives. Author

N75-32128*# Massachusetts Inst. of Tech., Cambridge. Electronics Systems Lab.
INVESTIGATION OF THE MULTIPLE MODEL ADAPTIVE CONTROL (MMAC) METHOD FOR FLIGHT CONTROL SYSTEMS Status Report, No. 3, 1 May - 30 Sep. 1975
1 Oct. 1975 28 p refs
(Grant NsG-1018; MIT Proj. OSP-81706)
(NASA-CR-119133; ESL-SR-626) Avail: NTIS HC $3.75 CSCL 01C

The application was investigated of control theoretic ideas to the design of flight control systems for the F-8 aircraft. The design of an adaptive control system based upon the so-called multiple model adaptive control (MMAC) method is considered. Progress is reported. Author

N75-32129# ARO, Inc., Arnold Air Force Station, Tenn.
A TECHNIQUE FOR MAPPING AIRCRAFT STABILITY BOUNDARIES Final Report, Jul. 1973 - Dec. 1974
James L. Taylor AEDC May 1975 56 p refs Sponsored by AF
(AD-A010492; ARO-PWT-TR-75-14; AEDC-TR-75-46) Avail: NTIS CSCL 20/4

This study presents a method for determining the effect that variations in design parameters may have on the transient response characteristics of a system of differential equations. The effects of single design parameter variations are described using a modified root locus technique. Simultaneous variations of two or three parameters are described using stability region maps. GRA

N75-32130# Systems Control, Inc., Palo Alto, Calif.
ANALYSIS OF CONTROLLER/SYSTEM DYNAMICS FOR A REMOTELY PILOTED VEHICLE STRIKE MISSION Final Report
Anil Phatak, Narendra Gupta, and Ilana Seagall May 1975 54 p refs
(Contract F33615-73-C-4021; AF Proj. 7222)
(AD-A009958; AMRL-TR-74-80) Avail: NTIS CSCL 01/3

The development of an analytical model for the remote human controller/vehicle dynamics during the critical phases of a remotely piloted vehicle (RPV) strike mission is a prerequisite for the quantitative understanding and evaluation of the overall mission effectiveness. The purpose of this report is to develop such a modeling approach and demonstrate its usefulness as an effective tool in the design of a baseline RPV strike mission. Analysis of the controller/vehicle dynamics is used to isolate the principal causes of degradations in the overall weapon system effectiveness. Insight gained from these analyses should prove extremely valuable in selecting a baseline configuration including specific recommentations for the choice of displays, the vehicle augmentation, and the overall RPV strike mission flight profile. GRA

N75-32131# Naval Postgraduate School, Monterey, Calif.
A MODEL BASED TECHNIQUE FOR FLIGHT DIRECTOR DESIGN: HELICOPTER HOVERING FLIGHT M.S. Thesis
Anthony John Palazzo, Jr. Mar. 1975 51 p refs
(AD-A009976) Avail: NTIS CSCL 01/2

A computer-aided optimal pilot modeling procedure was utilized to develop flight director laws for implementation in the longitudinal mode of a head-down cockpit display for a vertical take-off and landing aircraft. These flight director laws were intended to enhance the instrument hover and landing capabilities of the Bell UH-1H helicopter equipped with a multi-function stroke-written cathode ray tube display. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N75-32132 Wisconsin Univ., Madison.
MICROCHRONOMETRIC SCHLIEREN STUDY OF A HIGH-VOLTAGE SPARK DISCHARGE Ph.D. Thesis
Jimmy Wayne Hosch 1975 362 p
Avail: Univ. Microfilms Order No. 75-12903

A single mirror schlieren system of long focal length (f.l.) was employed to observe the index of refraction gradients in a high voltage spark discharge. The design considerations are presented for the construction of the 4000 mm. f.l. single mirror schlieren system on the optical bed with regards to spatial resolution and sensitivity requirements for gas flow and spark studies. A unidirectional current spark was produced by a hydrogen thyratron switched high voltage capacitive discharge. A nitrogen laser was used for the schlieren light source and synchronized to the spark. Schlieren photographs were recorded of single sparks sampled from the train of sparks synchronized to the line frequency of 60 Hz for various times before, during and after spark breakdown and current conduction. Three types of current waveform of spectrochemical interest were examined: fully oscillatory current; unidirectional current with decaying current peaks; unidirectional current with smooth over-damped decay. Dissert. Abstr

N75-32133*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A DESCRIPTION AND SOME MEASURED ACOUSTIC CHARACTERISTICS OF THE LANGLEY 220 CUBIC METER REVERBERATION CHAMBER

Arnold W. Mueller Sep. 1975 16 p refs
(NASA-TM-X-72775) Avail: NTIS HC $3.25 CSCL 14B

An initial acoustic calibration was performed for the NASA Langley Research Center reverberation chamber located on the aircraft Noise Reduction Laboratory. The physical characteristics of the chamber and measured data for the ambient acoustic levels, reverberation times, reflection coefficients, the spatial uniformity of acoustic energy as measured in the 1/3-octave bands from 40 Hz to 10 KHz and acoustic power levels of a standard source are described. Measured power levels compared very well with those published for the ILG standard source. The measured data indicate that for broadband noise fields, the reverberation room has acceptable acoustic performance in the frequency range from 100 Hz to 8 KHz. Author

N75-32134*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS FOR REDUCING AERODYNAMIC NOISE IN A WIND TUNNEL Patent Application
Paul W. Howard and Luke A. Schutzenhofer, inventors (to NASA) Filed 26 Aug. 1975 14 p
(NASA-Case-MFS-23099-1; US-Patent-Appl-SN-607969) Avail: NTIS HC $3.25 CSCL 14B

An invention designed to reduce background noise created in the test section of a transonic wind tunnel during aerodynamic testing was described. The novelty of the invention appears to lie in the placing of finely woven mesh screen over perforations formed in the porous wall members of the wind tunnel test section. This virtually eliminates the background noise which has heretofore influenced the aerodynamic measurements taken in transonic wind tunnels. Author

N75-32135# Transportation Research Board, Washington, D.C.
SKID RESISTANCE
Marianne Cox Wilburn, ed. 1974 161 p refs Presented at the 53d Ann. Meeting of the Highway Research Board
(PB-241458/9; TRB-TRR-523; ISBN-0-309-02368-8) Avail: NTIS HC $6.25 CSCL 13B

The papers in this record will be of interest to those practicing engineers involved in the design, construction, and maintenance of skid-resistant pavement surfaces as well as highway administrative and legal officials. The first group focuses on the legal liability of highway departments and personal liability of highway officials for injuries resulting from skidding accidents; the second group addresses the problem of measuring and predicting skid resistance properties of materials and surfaces; the third group covers the aspects of correcting skid resistance defficiencies by use of bituminous surface treatments; and the last paper discusses the wear and texturing of portland cement concrete pavements as they relate to skid resistance. Author (GRA)

N75-32136# Naval Air Engineering Center, Lakehurst, N.J. Engineering Dept.
SHIPBOARD INSPECTION AND TEST PROCEDURES FOR CERTIFICATION OF CV/CVA VISUAL LANDING AIDS FLIGHT DECK SURFACE LIGHTING AND MARKING
Daniel S. Nichols and William J. Biebel 10 Jan. 1975 29 p refs Revised
(AD-A009859; NAEC-ENG-7034-Rev-5) Avail: NTIS CSCL 13/10

This report presents a procedural format for the inspection and/or testing of CV and CVA hangar and flight deck marking and flight deck lighting systems to determine if the certification requirements of Visual Landing Aids General Service Bulletin No. 8 (latest Revision) are satisfied. GRA

N75-32137# Transportation Research Board, Washington, D.C.
AIR TRAVEL AND AVIATION FACILITIES PLANNING
1975 44 p refs
(PB-241929/9; TRB/TRR-529; ISBN-0-309-02376-9) Avail: NTIS HC $3.75 CSCL 01B

The papers presented examine various aspects of air transportation planning. They include a discussion of a development of a comprehensive assessment report for a regional airport-industrial complex; a study of the development and use of a demand model of domestic trunk air travel between New York City and other large cities; a description of a key implementation tool for financial planning applied to a major expansion of the metropolitan airport system in Louisville, Kentucky--a financial model that includes detailed forecasts with regional and national economic assumptions; and a study of a cost-effectiveness model for arriving at the best alternative or combination of alternatives for improving airport operations, with particular emphasis on decision changes in the air traffic control (ATC) system in the terminal area. GRA

N75-32138# New Mexico Univ., Albuquerque. Eric H. Wang Civil Engineering Research Facility.
SKID2 COMPUTER PROGRAM FOR REDUCTION OF RUNWAY SKID-RESISTANCE DATA Final Report, 27 Dec. 1973 - 15 Jun. 1974
Norman E. Rinehart Mar. 1975 83 p refs
(Contract F29601-74-C-0030; AF Proj. 2104)
(AD-A007049; AFWL-TR-74-180) Avail: NTIS CSCL 01/5

The FORTRAN Program SKID2 was developed to reduce data from the Air Force Weapons Laboratory (AFWL) standard skid-resistance tests. One of the main features of SKID2 is the preparation of a draft copy of a test report complete with graphs relating stopping distance and coefficient of friction with time-after-wetting. GRA

N75-32139# Naval Postgraduate School, Monterey, Calif.
THE A-7E WEAPON SYSTEM TRAINERS: AN ACQUISITION ANALYSIS M.S. Thesis
Stephen Joseph Baloga Mar. 1975 99 p refs
(AD-A010125) Avail: NTIS CSCL 15/5

To better understand the process and the conflicts inherent in the acquisition of training devices, a case history of A-7E Weapon System Trainer procurements is presented. An analysis of the role of training device procurement within the framework of the total ILS concept as applied to weapon system programs is attempted. Changing managerial perspectives are viewed as a consequence to lessons learned and the attendant realization of the need for practical tradeoffs in terms of trainer capability, cost and schedule. The intent is to illustrate the significant areas which warrant management's attention throughout the entire acquisition process. GRA

N75-32005 Calspan Corp., Buffalo, N.Y.
EXPERIMENTAL FACILITIES AND MEASUREMENT TECHNIQUES
Michael S. Holden *In* AGARD Two-Dimensional Shock Wave-Boundary Layer Interactions in High Speed Flows Jun. 1975 p 44-48 (For availability see N75-32001 23-01)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N75-32140*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSION DESIGN DATA FOR VENUS, MARS, AND JUPITER THROUGH 1990, VOLUME 1
Andrey B. Sergeyevsky 1 Sep. 1975 291 p refs 3 Vol.
(Contract NAS7-100)
(NASA-CR-143505; JPL-TM-33-736-Vol-1) Avail: NTIS HC $8.75 CSCL 22A

Data to be used in the selection and trajectory design of missions to Venus, Mars, and Jupiter during the 1975 - 1990 time period are presented. Author

N75-32141*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSION DESIGN DATA FOR VENUS, MARS, AND JUPITER THROUGH 1990, VOLUME 2
Andrey B. Sergeyevsky 1 Sep. 1975 235 p refs 3 Vol.
(Contract NAS7-100)
(NASA-CR-143506; JPL-TM-33-736-Vol-2) Avail: NTIS HC $7.50 CSCL 22A

For abstract, see N75-32140.

N75-32142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSION DESIGN DATA FOR VENUS, MARS, AND JUPITER THROUGH 1990, VOLUME 3
Andrey B. Sergeyevsky 1 Sep. 1975 330 p refs 3 Vol.

(Contract NAS7-100)
(NASA-CR-143507; JPL-TM-33-736-Vol-3) Avail: NTIS HC $9.50 CSCL 22A
For abstract, see N75-32140.

N75-32143*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MONOTECTIC AND SYNTECTIC ALLOYS: ASTP EXPERIMENT MA-044
Choh-Yi Ang (Univ. Space Res. Association) and Lewis L. Lacy 30 Sep. 1975 46 p refs
(NASA-TM-X-64956) Avail: NTIS HC $3.75 CSCL 11F

A postflight preliminary technical evaluation is presented of the returned samples of aluminum antimonide (AlSb) syntectic compound and lead-zinc (PbZn) monotectic immiscible processed during the Apollo-Soyuz Test Project (ASTP) mission. The returned cartridges, extracted ampoules, and removed samples were examined in detail. A genesis of the experiment is given along with a summary of the efforts and various scheduled tests up to the ASTP mission. A tentative characterization plan is developed from the postflight preliminary examination which makes use of the limited number of available samples and is based on the initial observations. It is indicated that a higher degree of compositional homogeneity in aluminum antimonide was achieved under flight test conditions. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N75-32144*# Martin Marietta Corp., Denver, Colo.
ORBITAL ASSEMBLY AND MAINTENANCE STUDY Final Report
D. Gorman, C. Grant, G. Kyrias, C. Lord, J. Rombach, M. Salis, R. Skidmore, and R. Thomas Aug. 1975 414 p refs
(Contract NAS9-14319)
(NASA-CR-144422; MCR-75-319-1) Avail: NTIS HC $10.50 CSCL 22A

The requirements, conceptual design, tradeoffs, procedures, and techniques for orbital assembly of the support structure of the microwave power transmission system and the radio astronomy telescope are described. Thermal and stress analyses, packaging, alignment, and subsystems requirements are included along with manned vs. automated and transportation tradeoffs. Technical and operational concepts for the manned and automated maintenance of satellites were investigated and further developed results are presented. J.M.S.

N75-32145*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSES OF THE SOLID EARTH AND OCEAN TIDAL PERTURBATIONS ON THE ORBITS OF THE GEOS-1 AND GEOS-2 SATELLITES
T. L. Felsentreger, J. G. Marsh, and R. W. Agreen Jul. 1975 33 p refs Submitted for publication
(NASA-TM-X-70969; X-921-75-194) Avail: NTIS HC $3.75 CSCL 22A

The luni-solar tidal perturbations in the inclination of the GEOS-I and GEOS-II satellite orbits were analyzed for the solid Earth and ocean tide conditions. Precision reduced camera and TRANET Doppler observations spanning periods of over 600 days for each satellite were used to derive mean orbital elements. Perturbations due to the earth's gravity field, solar radiation pressure, and atmospheric drag were modelled, and the resulting inclination residuals were analyzed for tidal effects. The amplitudes of the observed total tidal effects were about 1.2 arc seconds (36 meters) in the inclination of GEOS-I and 4.5 arc seconds (135 meters) for GEOS-II. The solid earth tides were then modelled using earth tide measurements, earth rotation observations, and seismic data. The resulting inclination residuals were analyzed for ocean tide parameters. The derived parameters consist of one second degree coefficient and an accompanying phase angle in a spherical harmonic expansion of the ocean tidal potential for each tidal constituent. The results are presented. Author

N75-32146*# Martin Marietta Corp., Denver, Colo.
PROGRAM TO OPTIMIZE SIMULATED TRAJECTORIES (POST). VOLUME 1: FORMULATION MANUAL Final Report
G. L. Brauer, D. E. Cornick, A. R. Habeger, F. M. Petersen, and R. Stevenson Apr. 1975 148 p refs 3 Vol.
(Contract NAS1-13611)
(NASA-CR-132689; MCR-75-143-Vol-1) Avail: NTIS HC $5.75 CSCL 22A

A general purpose FORTRAN program for simulating and optimizing point mass trajectories (POST) of aerospace vehicles is described. The equations and the numerical techniques used in the program are documented. Topics discussed include: coordinate systems, planet model, trajectory simulation, auxiliary calculations, and targeting and optimization. J.M.S.

N75-32147*# Martin Marietta Corp., Denver, Colo.
PROGRAM TO OPTIMIZE SIMULATED TRAJECTORIES (POST). VOLUME 2: UTILIZATION MANUAL Final Report
G. L. Bauer, D. E. Cornick, A. R. Habeger, F. M. Petersen, and R. Stevenson Apr. 1975 290 p 3 Vol.
(Contract NAS1-13611)
(NASA-CR-132690; MCR-75-143-Vol-2) Avail: NTIS HC $8.75 CSCL 22A

Information pertinent to users of the program to optimize simulated trajectories (POST) is presented. The input required and output available is described for each of the trajectory and targeting/optimization options. A sample input listing and resulting output are given. Author

N75-32148*# Martin Marietta Corp., Denver, Colo.
PROGRAM TO OPTIMIZE SIMULATED TRAJECTORIES (POST). VOLUME 3: PROGRAMMER'S MANUAL Final Report
G. L. Brauer, D. E. Cornick, A. R. Habeger, F. M. Petersen, and R. Stevenson Apr. 1975 242 p 3 Vol.
(Contract NAS1-13611)
(NASA-CR-132691; MCR-75-143-Vol-3) Avail: NTIS HC $7.50 CSCL 22A

Information pertinent to the programmer and relating to the program to optimize simulated trajectories (POST) is presented. Topics discussed include: program structure and logic, subroutine listings and flow charts, and internal FORTRAN symbols. The POST core requirements are summarized along with program macrologic. J.M.S.

N75-32149*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUPPLEMENT TO THE 1975 REPORT ON ACTIVE AND PLANNED SPACECRAFT AND EXPERIMENTS
Richard Horowitz, ed. and Leo R. Davis, ed. Jul. 1975 52 p
(NASA-TM-X-72580; NSSDC/WDC-A-R/S-75-06-Suppl) Avail: NTIS HC $4.25 CSCL 22A

A listing and brief description of spacecraft and experiments designed to update the January 1975 report on active and planned spacecraft and experiments to March 31, 1975 was presented. The information is given in two sections. In the first, spacecraft and experiments that have become known to NSSDC since the original report or that have changed significantly are described. In the second, an alphabatical listing is given for all spacecraft and experiments described in the first section and in the original report. It also updates status of operation and launch dates to March 31, 1975. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N75-32539 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE CURRENT PROGRAMME OF THE MOBILE RAKETEN-BASIS
R. Klein *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 35-42 (For availability see N75-32532 23-42)

N75-32568 Royal Norwegian Council for Scientific and Industrial Research, Blindern. Space Activity Div.
ANDOEYA ROCKET RANGE
R. Bjurstroem and A. Gundersen *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 317-322 (For availability see N75-32532 23-42)

N75-32569 Swedish Space Corp., Kiruna.
DEVELOPMENT AND PROVISION OF TECHNICAL EQUIPMENT AT ESRANGE DURING THE PERIOD JULY 1972 TO DECEMBER 1973
B. Eriksson *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 323-331 (For availability see N75-32532 23-42)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N75-32150# Lockheed Missiles and Space Co., Palo Alto, Calif.
ADDITIONAL CRITERIA IN THE PROBLEM OF DETERMINING THE ORIENTATION OF AN ARTIFICIAL SATELLITE NOT STABILIZED RIGIDLY
E. N. Kaurov [1975] 7 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 13, no. 3, 1975 p 337-342
Avail: NTIS HC $3.25; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Questions of relying upon additional information to determine the scanning trajectory over the celestial sphere by an optical axis of scientific instruments on board the 'Kosmos-215' are examined. The method developed permits determination of satellite orientation by fixing bright stars employing stellar photometer sensors and by using calculated and measured vectors of geomagnetic field intensity. Author

N75-32151*# Scientific Translation Service, Santa Barbara, Calif.
THE STORY OF THE FRENCH SOUNDING ROCKET VERONIQUE
Jean Corbeau Washington NASA Oct. 1975 28 p Transl. into ENGLISH from "L'histoire de la Fusee-Sonde Francaise Veronique", France Paper presented at 25th Intern. Astronautical Congr., Amsterdam, 30 Sep. - 5 Oct. 1974 Sponsored by NASA
(NASA-TT-F-16701; Paper-A74-32) Avail: NTIS HC $3.75 CSCL 22B

The development of the Veronique sounding rocket is discussed along with the present characteristics of the Veronique. Tables are included on the comparative characteristic of the various type of Veroniques and on the launches of the rockets. M.J.S.

N75-32152*# Scientific Translation Service, Santa Barbara, Calif.
THE USE OF ROCKETS IN POLAND: BEFORE 1940
Wladislaw Geisler Washington NASA Oct. 1975 5 p Transl. into ENGLISH from "L'usage des Fusees en Pologne: Avant 1940" 5 p
(NASA-TT-F-16702) Avail: NTIS HC $3.25 CSCL 16A

The history of Poland's use of rockets, going back to the 13th century is discussed. Data include rocket designers, rocket use, drawings, construction, and fuels. The military use of rockets was also included. E.H.W.

N75-32153*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACECRAFT CHARGING INVESTIGATION FOR THE CTS PROJECT
N. John Stevens, Robert R. Lovell (Communications Res. Center, Ottawa), and Victor Gore 1975 14 p refs Presented at Am. Geophysical Union Meeting, Washington, D. C., 16-20 Jun. 1975; sponsored by AIAA
(NASA-TM-X-71795; E-8473) Avail: NTIS CSCL 22B

Satellites in synchronous orbit have experienced electronic anomalies that are believed to be caused by discharges from spacecraft surfaces that were differentially charged by the space environment. Because of these environmentally induced anomalies, a program was undertaken to assess the impact of the discharge pulses on the joint Canadian-American Communications Technology Satellite (CTS). While this program includes both analytical and experimental investigations, only the experimental results to date are reported. All of the insulator surfaces tested experienced visible discharges when subjected to an electron beam with energy greater than 10 keV. The discharge rate was found to be a strong function of the current flux. Large areas of the insulator appeared to discharge in each event. The deployable solar array sample experienced discharges when bombarded on either the cell side or the kapton side. Author

N75-32154# National Environmental Satellite Service, Washington, D.C.
DATA COLLECTION SYSTEM GEOSTATIONARY ENVIRONMENTAL SATELLITE: PRELIMINARY
Merle L. Nelson Mar. 1975 55 p refs
(COM-75-10679/9; NOAA-TM-NESS-67; NOAA-75042802)
Avail: NTIS HC $4.25 CSCL 22B

The Data Collection System (DCS), which is part of the NOAA Geostationary Operational Environmental Satellite program and is under development at the National Environmental Satellite Service (NESS) is described. GRA

N75-32155# National Environmental Satellite Service, Washington, D.C.
GRAPHICAL RELATIONS BETWEEN A SATELLITE AND A POINT VIEWED PERPENDICULAR TO THE SATELLITE VELOCITY VECTOR (SIDE SCAN)
Irwin Ruff and Arnold Gruber Mar. 1975 20 p
(COM-75-10678/1; NOAA-TM-NESS-65; NOAA-75042205)
Avail: NTIS HC $3.25 CSCL 22C

This report presents a procedure for calculating the position of an orbiting satellite when only the geographical coordinates of a point viewed by an instrument scanning perpendicular to the satellite velocity vector are known. This capability is valuable when using archived data, which do not include orbital specifics, to study, for example, angular patterns of reflected energy. The equations are derived and solved assuming a spherical earth and a circular orbit. A brief discussion of the effects on the solutions of noncircular orbits and an ellipsoidal earth is also presented. GRA

N75-32533 Centre National d'Etudes Spatiales, Paris (France).
FRENCH NATIONAL SOUNDING-ROCKET AND BALLOON PROGRAMME RELATED TO THE IMS
M. Aubert *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 5-6 (For availability see N75-32532 23-42)

N75-32534 Science Research Council, Slough (England).
BRITISH SOUNDING-ROCKET PROGRAMME AND THE ESRANGE SPECIAL PROJECT
G. W. Eastwood *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 7-9 refs (For availability see N75-32532 23-42)

N75-32535 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
GERMAN NATIONAL SCIENTIFIC BALLOON AND SOUNDING ROCKET PROGRAMME
D. Joneleit *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern.

Magnetospheric Study (IMS) Feb. 1975 p 11-17 (For availability see N75-32532 23-42)

N75-32536 Austrian Space Agency, Vienna.
AUSTRIA'S SOUNDING ROCKET AND SCIENTIFIC BALLOON PROGRAMME
J. Ortner *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 25-26 (For availability see N75-32532 23-42)

N75-32537 Swedish Space Corp., Stockholm.
SWEDISH SOUNDING ROCKET PROGRAMME FOR 1974-1978
P. Nobinder *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 27-29 (For availability see N75-32532 23-42)

N75-32538 Denver Univ., Colo.
THE INTERNATIONAL MAGNETOSPHERIC STUDY 1976 - 1978
J. G. Roederer *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 31-33 (For availability see N75-32532 23-42)

N75-32565 Naval Research Lab., Washington, D.C. Space Science Div.
THE ARIES CONTROLLED SOUNDING ROCKET
R. D. Arritt and C. S. Dugan (Space Vector Corp., Northridge, Calif.) *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 279-294 (For availability see N75-32532 23-42)

N75-32566 Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
PROJECT PORCUPINE: A STEP TOWARDS UNDERSTANDING THE AURORA
G. Haerendel and R. Klett (Ingenieurbuero Klett) *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 295-230 (For availability see N75-32532 23-42)

N75-32567 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DFVLR ACTIVITIES FOR THE IMS-ARIES PROJECT
H. Bader *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 301-305 refs (For availability see N75-32532 23-42)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N75-32156# Illinois Univ., Urbana. Dept. of Computer Science.
TELEMAZE: A FEEDBACK CONTROL SYSTEM FOR THE REMOTE POSITIONING OF A DISTANT EXPLORATORY VEHICLE M.S. Thesis
Edward James Pott Oct. 1974 93 p refs
(Contract N00014-67-A-0305-0024)
(AD-A010158; UIUCDCS-R-74-683) Avail: NTIS CSCL 22/1

It is well known that feedback for on-line operation is useful only if the delay in the loop is short enough. A typical example where feedback is nearly useless is the remote control of an exploratory vehicle on a distant planet. TELEMAZE is a simulator for this situation. Guidance of the vehicle is obtained by steering an image of the vehicle through an environmental model stored in a local display system. GRA

N75-32157# Honeywell, Inc., St. Petersburg, Fla. Aerospace Div.
FLIGHT TEST PREPARATION OF THE ELECTRICALLY SUSPENDED ACCELEROMETER, PHASE 3 Final Report, 15 Oct. 1973 - 30 Nov. 1974
Donald F. Elwell and Barry K. Likeness 31 Mar. 1975 183 p
(Contract F04701-74-C-0052)
(AD-A010107; SAMSO-TR-75-50) Avail: NTIS CSCL 22/2

The program goal was to repair, modify, test, calibrate and prepare two Electrically Suspended Accelerometers (ESA) for a space flight test. Calibration data was collected with the ESA mounted in a flotation chamber which provides the means of controlling static forces in the range of 0.01 to 0.0000001 g as test input to the accelerometer. Test data were fitted to candidate math models of the ESA; the models contain terms which describe the bias, scale factor and cross coupling characteristics of the accelerometer. Performance data on the instrument are presented for each of the two calibration tests. The report describes the electrical noise problem which was encountered and which affected the accelerometer calibration. A computer based simulation of the ESA was made to study its expected operation in space. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N75-32158*# Boeing Aerospace Co., Seattle, Wash. Space Systems Div.
FEASIBILITY STUDY OF THE BOEING SMALL RESEARCH MODULE (BSRM) CONCEPT Final Report
Mar. 1975 113 p refs
(Contract NAS2-8526)
(NASA-CR-137743) Avail: NTIS HC $5.25 CSCL 22B

The design, capabilities, and subsystem options are described for the Boeing Small Research Module (BSRM). Specific scientific missions are defined and the BSRM capability to support these missions is discussed. Launch vehicle integration requirements and spacecraft operational features are also presented. Author

N75-32159*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE
Feb. 1975 80 p
(NASA-TM-X-72873) Avail: NTIS HC $4.75 CSCL 22B

A general description of the space shuttle program is presented, with emphasis on its application to the use of space for commercial, scientific, and defense needs. The following aspects of the program are discussed: description of the flight system (orbiter, external tank, solid rocket boosters) and mission profile, direct benefits related to life on earth (both present and

expected), description of the space shuttle vehicle and its associated supporting systems, economic impacts (including indirect benefits such as lower inflation rates), listing of participating organizations. Y.J.A.

N75-32160*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPOSITE LATTICE STRUCTURE
Marvin D. Rhodes and Martin M. Mikulas, Jr. Sep. 1975 28 p refs
(NASA-TM-X-72771) Avail: NTIS HC $3.75 CSCL 22B

A lattice type structural panel concept which exploits the unidirectional character of filamentary advanced composite materials was described. This lattice has potential for applications where stiff lightweight structures are needed such as large area panels for space satellites. Formulae are presented to calculate the panel weight and plate bending stiffness. This analysis indicates that structures with significantly lighter weight than conventional minimum gauge sandwich construction can be fabricated. A suggested fabrication procedure is also presented along with photographs of some typical panels. Author

N75-32161*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUPPLEMENT TO THE DECEMBER 1974 SPACE INVESTIGATION DOCUMENTATION SYSTEM (SIDS) REPORT
Jul. 1975 28 p
(NASA-TM-X-72581; NSSDC-75-05-Suppl) Avail: NTIS HC $3.75 CSCL 22B

A listing and brief description of spacecraft and experiments designed to update the December 1974 Space Investigations Documentation System (SIDS) report to March 31, 1975 was presented. The information is given in two sections. In the first, spacecraft and experiment descriptions are sorted by spacecraft common name. Within each spacecraft lising, experiments are sorted by the principal investigator's or team leader's last name. Each spacecraft entry heading contains the spacecraft common name, alternate names, NSSDC ID code, last reported state of the spacecraft, actual or planned launch date, weight, launch site and vehicle, sponsor, orbit parameters, personnel. Each experiment entry heading contains the experiment name, NSSDC ID code, last reported status, the Office of Space Science (OSS) division, the relevant SIDS disciplines, personnel. In the second, all spacecraft and experiment names described in the previous section and in the December 1974 report are sorted out. Author

N75-32162# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
MINUTEMAN STAGE 3 COMPONENT REPORT
Elizabeth M. Dalaba Apr. 1975 57 p refs
(AD-A010522; MANCP-320(75)) Avail: NTIS CSCL 21/8

This report contains the results of the 1974 testing on LGM-30 Stage 3 Wing 4 unique (OPRI) specimens performed under MMEMP Project 75-246, M62419M. GRA

N75-32163# Defense Documentation Center, Alexandria, Va.
SPACE STATIONS Report Bibliography, Jan. 1967 - Jul. 1974
May 1975 372 p refs Revised
(AD-A010500; DDC-TAS-75-10-Rev) Avail: NTIS CSCL 22/2

This bibliography contains unclassified and unlimited citations on space stations. These citations provide information emphasizing aerodynamic characteristics, checkout procedures, control systems, telemeter systems, electrical power systems, safety, navigation, space maintenance, space propulsion, and extravehicular activity. It also includes pertinent information on space shuttles and their operational characteristics. Four computer-generated indexes are provided. They are Corporate Author-Monitoring Agency, Subject, Title, and Personal Author. GRA

N75-32545 European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
SITUATION REPORT ON GEOS
K. Knott *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 143-148 (For availability see N75-32532 23-42)

N75-32546 European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
GEOS FIELD AND WAVE EXPERIMENTS
A. Pedersen *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 149-157 (For availability see N75-32532 23-42)

N75-32547 University Coll., London (England). Mullard Space Science Lab.
GEOS PARTICLE EXPERIMENTS
G. L. Wrenn *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 159-165 refs (For availability see N75-32532 23-42)

N75-32548 European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
OUTLINE AND PROGRESS OF THE INTERNATIONAL SUN-EARTH EXPLORER PROJECT
A. C. Durney *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 167-174 (For availability see N75-32532 23-42)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N75-32164*# Rocketdyne, Canoga Park, Calif.
SPACE SHUTTLE ORBIT MANEUVERING ENGINE REUSABLE THRUST CHAMBER PROGRAM Final Summary Report
R. P. Pauckert and R. D. Tobin 13 Mar. 1975 58 p
(Contract NAS9-12802)
(NASA-CR-144441; R-9686-1) Avail: NTIS HC $4.25 CSCL 21H

Analyses and preliminary designs of candidate OME propellant combinations and corresponding engine designs were conducted and evaluated in terms of performance, operating limits, program cost, risk, inherent life and maintainability. For the Rocketdyne recommended and NASA approved propellant combination and cooling concept (NTO/MMH regeneratively cooled engine), a demonstration thrust chamber was designed, fabricated, and experimentally evaluated to define operating characteristics and limits. Alternate fuel (50-50) operating characteristics were also investigated with the demonstration chamber. Adverse operating effects on regenerative cooled operation were evaluated using subscale electrically heated tubes and channels. An investigation of like doublet element characteristics using subscale tests was performed. Full scale 8- and 10-inch diameter like-doublet injectors for the OME were designed, fabricated, and tested. Injector stability was evaluated analytically and experimentally. Author

N75-32165*# Rocketdyne, Canoga Park, Calif.
SPACE SHUTTLE ORBIT MANEUVERING ENGINE Final Report

R. P. Pauckert 29 Aug. 1975 214 p
(Contract NAS9-12802)
(NASA-CR-144440; R-9686) Avail: NTIS HC $7.25 CSCL 21H

Data on the performance, stability, and thermal characteristics of an OME operating with an alternate injector configuration and with alternate propellants was obtained. The design, manufacturing, and operating characteristics of an electroformed, regeneratively cooled thrust chamber were also derived. Subscale and full scale tests provide data relating to off-design and transient operation. Author

N75-32166*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION BEAM THRUSTER SHIELD Patent Application
J. L. Power, inventor (to NASA) Filed 12 Sep. 1975 25 p
(NASA-Case-LEW-12082-1; US-Patent-Appl-SN-612964) Avail: NTIS HC $3.25 CSCL 21C

An ion thruster beam shield comprised of a cylindrical housing and a number of annular vanes which are spaced along the length of the housing is described. The shield intercepts and stops all charge exchange and beam ions, neutral propellant, and sputter products formed due to the interaction of beam and shield from emanating outside the ion thruster. The shield further prevents the sputter products formed during the operation of the engine from escaping the interior volume of the shield. NASA

N75-32167*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SYSTEM RELIABILITY ANALYSIS THROUGH CORONA TESTING
Vincent R. Lalli, Lawrence A. Mueller, and Ernest A. Koutnik Washington Sep. 1975 23 p refs
(NASA-TM-X-3287; E-8246) Avail: NTIS HC $3.25 CSCL 14B

A corona vacuum test facility for nondestructive testing of power system components was built in the Reliability and Quality Engineering Test Laboratories at the NASA Lewis Research Center. The facility was developed to simulate operating temperature and vacuum while monitoring corona discharges with residual gases. The facility is being used to test various high-voltage power system components. Author

N75-32168*# LTV Aerospace Corp., Dallas, Tex.
DEVELOPMENT AND PARAMETRIC EVALUATION OF THE PROTOTYPE 2 AND 3 FLASH EVAPORATORS Final Report
C. W. Hixon and J. B. Dietz 18 Jul. 1975 233 p refs
(Contracts NAS9-13074; NAS9-13506)
(NASA-CR-144446; T157-76) Avail: NTIS HC $7.50 CSCL 22B

Development of the Prototype 2 and 3 flash evaporator heat sinks which vaporize an expendable fluid to cool a heat transport fluid loop is reported. The units utilize Freon 21 as the heat transport fluid and water as the expendable fluid to meet the projected performance requirements of the space shuttle for both on-orbit and ascent/reentry operations. The evaporant is pulse-sprayed by on-off control onto heat transfer surfaces containing the transport fluid and exhausted to the vacuum environment through fixed area exhaust ducts. Author

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N75-32169*# Rice Univ., Houston, Tex.
RESEARCH ON MATERIALS FOR ADVANCED ELECTRONIC AND AEROSPACE APPLICATION Semiannual Status Report, 1 Jul. 1974 - 30 Jun. 1975
30 Jun. 1975 40 p refs
(Grant NGR-44-006-001)
(NASA-CR-119134; SASR-30) Avail: NTIS HC $3.75 CSCL 11G

Development and understanding of materials most suitable for use in compact magnetic and optical memory systems are discussed. Suppression of metal deterioration by hydrogen is studied. Improvement of mechanical properties of polymers is considered, emphasizing low temperature ductility and compatibility with high modulus fiber materials. Author

N75-32170# California Univ., Los Angeles. Dept. of Chemistry.
REACTION OF PHENYLBORON DICHLORIDE WITH CYCLOPENTADIENYLDICARBOLLYLCOBALT Interim Report
Richard N. Leyden and M. Frederick Hawthorne 9 May 1975 11 p refs
(Contract N00014-75-C-0301; NR Proj. 053-481)
(AD-A010193; Contrib-3452; TR-86) Avail: NTIS CSCL 07/3

Reduction of 3-(eta5-C5H5)-3,1,2-Co-(eta5-C2B9H11) with 3 equivalents of sodium followed by addition of phenylboron dichloride results in insertion of a boron atom exclusively in the cyclopentadienyl ring to yield 3-(1-C6H5-(eta6-C5BH5))-3,1,2-Co-(eta5-C2B9H11). GRA

N75-32171# American Cyanamid Co., Bound Brook, N.J.
RESEARCH ON THE SYNTHESIS OF NOVEL COMPOUNDS ABSORBING IN THE NEAR INFRARED REGION OF THE SPECTRUM Final Technical Report, 3 Jan. 1973 - 12 Dec. 1974
Allan E. Sherr, Robert J. Tucker, Richard H. Spector, and Houston G. Brooks, Jr. 15 Jan. 1975 56 p refs
(Contract DAAA25-73-C-0253; DA Proj. 1T1-61102-A-31-C-05)
(AD-A006575; DI-S-1800) Avail: NTIS CSCL 07/3

Several polynuclear aromatic compounds were synthesized leading to the production of nickel complexes of sulfur-oxygen polynuclear aromatic structures. The near infrared spectral properties of the complexes were measured. The complexes were found to absorb between 1000-1600 nm. Plastic powders were prepared by incorporation of selected near infrared absorbing compounds into appropriate plastic substrates and reducing the granulated plastic-absorber structures to a particle size below 300 microns. The fine particulate matter had absorption in the region 800-1500 nm. GRA

N75-32172# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HALOGENATION AND HYDROHALOGENATION OF OLEFINS IN SOLID PHASE
G. B. Sergeev 12 Nov. 1974 38 p refs Transl. into ENGLISH from the mono "Problemy Kinetki Kataliza. 15: Mekhanizm i Kinetika Geterogennykh Reaktsii" Moscow, 1973 p 220-232
(AD-A001847; FTD-MT-24-1772-74) Avail: NTIS CSCL 07/3

The report discusses a study of low temperature solid phase halogenation and hydrohalogenation of olefins. Kinetics are discussed. Also included are abstracts of reports on research in two general areas -- mechanism and kinetics of heterogeneous catalytic reactions, and mechanism and kinetics of reactions in solid phase. GRA

N75-32173# California Univ., Los Angeles. Dept. of Chemistry.
CHEMISTRY OF MONOCARBON METALLOCARBORANES INCLUDING POLYHEDRAL REARRANGEMENTS IN MIXED-METAL BIMETALLOCARBORANES
Chris G. Salentine and M. Frederick Hawthorne 15 May 1975 41 p
(Contract N00014-75-C-0301; NR Proj. 053-481)
(AD-A010195; Contrib-3426; TR-87) Avail: NTIS CSCL 07/3

The synthesis and characterization of four isomers of the mixed-metal bimetallocarborane (C5H5)2CoNiCB7H8 are reported. These species have been found to undergo novel thermal polyhedral rearrangements wherein metal atoms migrate to adjacent polyhedral vertices and remain there, constituting the first example of a thermally stable metal-metal interaction in a metallocarborane. Also described are some brominated derivatives and their thermal rearrangements. A general rearrangement scheme for ten-vertex polyhedra is developed and used in the analysis of polyhedral rearrangements and assignment of structures. In an attempt to synthesize a larger homologue

of this mixed-metal species the authors isolated (eta-C10H8)Co(III) CB10H11, the first metallocarborane containing a neutral arene ligand bound to the metal. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N75-32174 Princeton Univ., N.J.
MECHANICAL BEHAVIOR AND BONDING IN NON-WOVENS Ph.D. Thesis
Charles James Shimalla 1974 153 p
Avail: Univ. Microfilms Order No. 75-20661

Determination of the type of bonding involved in polypropylene and poly(ethylene terephthalate) base fiber nonwovens was examined by scanning electron microscopy. Cohesive failures were obtained only for high bonding temperatures in which a partial melting of the base fiber surface occurs. A two-level fractional factorial experiment was used to determine the significant variables in the physical, mechanical, and filtration properties of the model nonwovens. The controlled variables include base fiber type, binder concentration, bonding temperature, quench temperature, and annealing. Of particular significance is the fact that the properties of the nonwovens are sensitive to these variations in the interfiber bonding. The relative distance between bonds was one of the critical parameters in filtration applications of these nonwovens. Variables which tended to increase the level of bonding, web stiffness, and fiber packing lowered the filtration performance. The multitude of physical, mechanical, and filtration reponses of experimental nonwoven card webs was examined by principal component analysis. Dissert. Abstr.

N75-32175 Boston Coll., Chestnut Hill, Mass.
GROWTH OF POLYCRYSTALLINE SILICON FILM ON METAL SUBSTRATES Ph.D. Thesis
Linda M. Ephrath 1975 172 p
Avail: Univ. Microfilms Order No. 75-20702

Adherent, polycrystalline silicon films were deposited onto titanium passivated steel alloy substrates at substrate temperatures between 535 and 650 C and onto aluminum films at substrate temperature between 480 and 520 C. The mechanism for the growth of polycrystalline silicon films on aluminum layers is explained in terms of growth from seed silicon crystals. The precipitation of the seed crystals is induced by the aluminum layer at a temperature 100 C below the silicon-aluminum eutectic temperature. Optical microscopy, scanning electron microscopy, and X-ray diffraction measurements were utilized to determined silicon grain size, morphology, and crystallographic orientation. Dissert. Abstr.

N75-32176 New Mexico Univ., Albuquerque.
PLASTIC RELAXATION AROUND CRACK TIP IN COMPOSITE MATERIALS Ph.D. Thesis
Chung-Yen Huang 1974 133 p
Avail: Univ. Microfilms Order No. 75-18652

The concept of continuously distributed dislocations was used to investigate the mechanical behavior of fractured composite materials. As a first approximation to the complicated physical configuration of a composite material, a simplified physical model is discussed by considering an elastic circular medium such that an internal line crack starts from the interface and extends in the radial direction of the inclusion. The plastic zone spreads and extends from the crack tip when the entire system is subjected to a uniformly distributed shear load at infinity; this constitutes an anti-plane deformation. Effects of the inclusion on parameters were examined: (1) the distribution of dislocation along the crack and the plastic zone, (2) the relationship between the applied load and the plastic zone (3) the shear displacement along the crack and the plastic zone, (4) the crack opening displacement at the crack tip, and (5) the fracture load by using critical crack tip opening displacement criterion for fracture. Dissert. Abstr.

N75-32177 Princeton Univ., N.J.
THE FRACTURE MECHANICS, MORPHOLOGY, AND STATISTICS OF NYLON 66 FIBER Ph.D. Thesis
Michael Joseph Mutz 1974 148 p
Avail: Univ. Microfilms Order No. 75-20653

The ultimate tensile properties of a specific nylon monofil were investigated. Both the breaking stress and extension to break are highly correlated to the breaking strength. Since the breaking strength is readily determinable from a load-extension curve, all computations and results are based upon strength measurements. A statistical theory of fracture predicts that a Weibull distribution may fit the data. When this distribution is coupled with a chain-type series model, certain predictions concerning the parameters of the Weibull distribution are derived. Through these predictions, the chain-type weak link theory proves to be an inadequate model, although a bivariate Weibull distribution does fit the data reasonably well. Annealing decreases the variance of the distribution and reduces the modality of the distribution. An explanation, based upon assuming the existence of different flaw types in the fiber, is presented. The morphology of fracture was investigated. Two distinct regions are found, and these regions are functions of fiber strength. Annealing has no profound effect upon fracture surface morphology. Dissert. Abstr.

N75-32178 State Univ. of New York, Buffalo.
STUDIES OF NON-STOICHIOMETRIC ALUMINA Ph.D. Thesis
Abraham S. Birnbaum 1975 253 p
Avail: Univ. Microfilms Order No. 75-18773

As one approach to establishing the relative stability of lower-valent aluminum oxides, electrostatic lattices energies (Madelung) for gamma alumina were calculated. A modified direct summation method of adding over concentric surfaces was developed. The method is unconventional in that the allocation of charges is weighted average to insure electrical neutrality in the volume being considered. This avoids the problems in Evjen summation, even for cubic structures, of (1) non-neutrality of cells and (2) of double layers or dual sums. The computed energies give good agreement to the known difference in heat of formation for gamma versus alpha alumina. The method appears equally applicable to computation of surface Madelung energies. Three models of the (100) planes of gamma-alumina were considered. Calculations were made of the energy change for the reduction of a (100) surface of gamma-alumina to AlO or Al on Al2O3 substrate by computation of the lattice energies for such surface ions. Dissert. Abstr.

N75-32179# National Aerospace Lab., Tokyo (Japan).
STATIC AND FLEXURAL FATIGUE STRENGTH OF KEVLAR-49/EPOXY COMPOSITES
Toshiyasu Furuta, Yoshio Noguchi, and Masamichi Matsushima May 1975 20 p refs In JAPANESE; ENGLISH summary (NAL-TR-413) Avail: NTIS HC $3.25

KEVLAR-49 is described as a reinforcement for composites, which has a tensile strength similar to carbon fibers; it consists of matrices of epoxy (Epon 828). Static mechanical tests performed included determination of tensile and flexural strength, Young's modulus, interlaminar shear strength, and Poisson's ratio. Poisson's ratio was determined by using the laser holography method and the strain gage method. The repeated flexural fatigue property was determined by using the NAL type fatigue tester of a constant load type. It was found that KEVLAR-49 composites have lower flexural strength than carbon fiber composites. In order to improve this property a hybrid of KEVLAR-49 and carbon fiber composite was developed; the hybrid was found to have sufficient flexural and fatigue strength for use as structural material. Author

N75-32180*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYBRID COMPOSITE LAMINATE STRUCTURES Patent Application
C. C. Chamis and R. F. Lark, inventors (to NASA) Filed 24 Sep. 1975 31 p
(NASA-Case-LEW-12118-1; US-Patent-Appl-SN-616332) Avail: NTIS HC $3.75 CSCL 11D

The invention is related to laminate structures and specifically to essentially anisotropic fiber composite laminates. Metal foils are selectively disposed within the laminate to produce increased resistance to high velocity impact, fracture, surface erosion, and other stresses. NASA

N75-32181# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
THE EFFECTS OF PROCESSING PARAMETERS ON THE MECHANICAL PROPERTIES OF ALUMINUM-GRAPHITE COMPOSITES
William C. Harrigan, Jr. and David M. Goddard 22 Apr. 1975 25 p refs
(Contract F04701-74-C-0075)
(AD-A010108; TR-0075(9250-03)-4; SAMSO-TR-75-111) Avail: NTIS CSCL 11/4

Aluminum-graphite composites are produced through molten infiltration of aluminum into continuous tows of graphite fibers by means of a process developed by The Aerospace Corporation. This process produces a continuous rod of composite that is subsequently fabricated into larger structures. This fabrication step involves hot-pressing of the wires in temperature ranges where the matrix is fully solid, fully liquid, or partially liquid and solid. The influence of the temperature region of fabrication on the final mechanical properties is discussed. The effects of cleaning of the precursor rod on the bonding of this composite are demonstrated. Fracture analysis with scanning electron microscopy is used to demonstrate the role of pressing parameters on the fracture process and the resulting mechanical properties. GRA

N75-32182# Southern Methodist Univ., Dallas, Tex. Dept. of Civil and Mechanical Engineering.
NONLINEAR DEFORMATION OF GRAPHITIC MATERIALS Final Report, Mar. 1973 - Jun. 1974
Robert M. Jones and Dudley A. R. Nelson, Jr. Feb. 1975 163 p refs
(Contract F33615-73-C-5124; AF Proj. 627A)
(AD-A010425; AFML-TR-74-259) Avail: NTIS CSCL 11/2

Artificial graphites have been used for the past decade in reentry vehicle nosetips. Severe design requirements are imposed on nosetips because of their operational environment. A new model for the deformation behavior of this group of nonlinear transversely isotropic materials under initial loading is described. This material model, which is based on a new deformation theory of orthotropic plasticity, has excellent potential for description of the unusual phenomenon of biaxial (multiaxial) softening found in ATJ-S graphite. Biaxial softening is characterized by the development of larger strains in biaxial tension than in uniaxial tension, in contradiction to conventional Poisson effects. Moreover, another characteristic of graphite deformation behavior, different moduli in tension and compression, is accounted for. Comparisons are made between strain values obtained with the material model incorporated in a finite element computer analysis and strain values measured in off-axis uniaxial tests and biaxial tests. GRA

N75-32183# General Electric Co., Schenectady, N.Y.
EXPLORATORY DEVELOPMENT FOR SYNTHESIS AND EVALUATION OF DIRECTIONALLY SOLIDIFIED COMPOSITES FOR HIGH TEMPERATURE APPLICATION Final Report, 15 Jun. 1972 - 14 Jun. 1973
Mark G. Benz, Edward R. Buchanan, Loxley V. Hampton, Michael F. Henry, and Melvin R. Jackson Sep. 1974 243 p refs
(Contract F33615-72-C-1870; AF Proj. 7351)
(AD-A000943; SRD-74-015; AFML-TR-73-213) Avail: NTIS CSCL 11/4

The major goal of this program was to fully evaluate the potential of TaC-reinforced eutectic Co alloys, particularly cobalt-base, for use in aircraft gas turbine applications. The subjects covered in this report include: critical properties, identification and evaluation (prestrain, thermal cycling, thermal cycling under load, low cycle fatigue, microstructural stability, long-time rupture, off-axis properties, oxidation, and hot corrosion; Composition (alloying to improve stress rupture behavior); and processing (Solidification). Also included as appendices to this report, is work sponsored by the General Electric Company in areas of interest to the current effort. The subjects covered in these appendices include: Background studies in monocarbide-reinforced eutectic alloys, impact, thermal shock, thermal cycling model, and coatings. (Modified author abstract) GRA

N75-32184# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FIBROUS SIZED MATERIALS FROM HETEROGENIC FIBERS
V. B. Tikhomirov and M. V. Frolov 20 Nov. 1974 13 p Transl. into ENGLISH from the mono "Problemy Fiziko-Khimicheskoi Mekhaniki Voloknistykh i Poristykh Dispersnykh Struktur i Materialov. Materialy Konferentsii 18-21 May 1965" Riga, 1967 p 287-292
(AD-A002898; FTD-MT-24-2770-74) Avail: NTIS CSCL 11/5

A study was made on the properties of a new type of sized fibrous materials - nonwoven materials made from heterogeneous fibers. It was shown that the use of heterogeneous fibers makes it possible to obtain fibrous sized materials having a point structure. It is established that the sized materials made from heterogeneous fibers are distinguished by increased strength in conjunction with good air permeability. GRA

N75-32185# Marks Polarized Corp., Whitestone, N.Y.
SUPERHARD TRANSPARENT COATINGS Final Report
Alvin Melville Marks Apr. 1975 74 p refs
(Contract DAAJ02-73-C-0062; DA Proj. 1F1-62205-A-119)
(AD-A010388; USAAMRDL-TR-75-22) Avail: NTIS CSCL 11/3

The purpose of this work is to develop and provide a superhard coating (Moh hardness = 5) which is transparent and which will adhere to various polymeric sheet substrates. This coating is to protect helicopter transparencies from scratching and objectionable visual effects, and to avoid frequent replacement. These coatings comprise submicron hard particles in a polymeric matrix. Submicron particles of various compositions and shapes were incorporated in a compatible solution of a polymeric matrix coated on a substrate and tested to determine their physical and optical properties. The compositions selected comprised a dehydrated polyvinyl silicate chemically bound to silica or aluminum oxide particles. Optimum compositions and particle shapes were determined. GRA

N75-32186# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
EFFECTS OF GRAPHITE-EPOXY COMPOSITE MATERIALS ON THE CORROSION BEHAVIOR OF AIRCRAFT ALLOYS
P. Fischer and J. DeLuccia 3 Apr. 1975 38 p refs
(AD-A010127; NADC-75031-30) Avail: NTIS CSCL 11/6

The electrochemical approach was used to show the nature of the galvanic corrosion when graphite-epoxy composite materials are coupled to aluminum and titanium alloys. An open circuit potential difference of one volt was obtained in 3.5% NaCl solution between the composite and 7075-T6, 7075-T651 and 5052-H38 alloys. This potential difference provides a driving force for corrosion and is cause for concern. The Ti-6-4 showed a difference of about 0.3 volt for the unpolished as received material. Corrosion current data (zero impedance technique) indicate that aluminum alloys and cadmium plate are much more reactive than Ti-6-4 when coupled to graphite-epoxy. This technique provides a means of ranking the severity of this corrosion problem for various aircraft alloys. Flatwise tensile data indicate significant strength losses when graphite-epoxy composite sandwich specimens are exposed to ASTM 5% salt spray and synthetic sea water - SO2 spray environments. GRA

N75-32187# Textron, Inc., Buffalo, N.Y. Bell Aerospace Div.
ANALYSIS OF MULTIPLE PARTICLE IMPACTS ON BRITTLE MATERIALS Summary Report, Jun. 1973 - Jun. 1974
William F. Adler Sep. 1974 92 p refs
(Contract F33615-71-C-1528; AF Proj. 7342)
(AD-A002876; AFML-TR-74-210) Avail: NTIS CSCL 11/2

While glass specimens behave in a characteristic manner when subjected to multiple collisions by glass beads, this behavior pattern cannot be associated with the erosion characteristics of all brittle or semi-brittle materials. On the other hand the general model is applicable to the erosion of any material which can be described in terms of a process of pit nucleation and growth and does not depend on the erosive environment. A demonstrated capability has been established in identifying the microscopic erosion mechanisms responsible for material removal and their relation to the microstructure of the material. Micromechanical models developed on the basis of the microscopic observations of the operative erosion mechanisms at various stages of the overall erosion process can then be incorporated into the

general erosion model. This program is under development for describing the rain erosion of polymethylmethacrylate. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N75-32188 Tufts Univ., Medford, Mass.
ACOUSTIC PROPERTIES OF SOME CRYSTALLINE AND POLYCRYSTALLINE MATERIALS Ph.D. Thesis
Woan-mei Wang Chu 1974 148 p
Avail: Univ. Microfilms Order No. 74-28560

Longitudinal and transverse sound velocities of hot-pressed cadmium sulfide and of hot-pressed magnesium fluoride were measured in a temperature range from 4.2 K to 293 K, by the pulse-echo method. The polycrystalline isotropic elastic moduli obtained as a function of temperature are in excellent agreement with the corresponding single crystal constants. In addition, ultrasonic attenuation measurements were made on both hot-pressed materials as well as on single crystals of these materials. These measurements were in the megahertz frequency range and covered the same temperature range. Longitudinal and transverse waves were again introduced. The data were successfully analyzed using models based on the Akhieser effect and piezoelectric effect. The analysis shows that the existing theories account extremely well for the various measurements made. Dissert. Abstr.

N75-32189 Princeton Univ., N.J.
SPECTROSCOPIC STUDIES OF IONIC SOLUTIONS Ph.D. Thesis
Chiang Jung Cheng 1974 107 p
Avail: Univ. Microfilms Order No. 75-20620

The infrared and NMR spectra of HDO and MeOH at low concentrations in acetonitrile, propylene carbonate, 1, 1, 3, 3, tetramethyl, and N, N, dimethylformamide containing various salts were studied. The results indicate that as many as 4 OH stretching bands for HDO or MeOH can be detected. The multiple bonds suggest the presence of solvent-bonded, cation-bonded, anion-bonded, and solvent shared/or solvent separated ion aggregate species. Solvent properties such as donicity, basicity, and dielectric constant are the major factors in determining the extent of ion pair dissociation and the interactions between HDO or MeOH and ions. Cation-water interactions are proportional to the charge/radius ratio. The dielectric constant of a solvent dominates the solvation reaction of the salts while the solvent donicity dominates the ion pair dissociation. The dependence of the infrared spectra on the water concentration in the presence of salts also suggests the existence of solvent separated ion aggregates. Association constants of water and MeOH with individual ions were determined. Dissert. Abstr.

N75-32190 Wisconsin Univ., Madison.
OPTIMIZATION OF MODULAR PROCESS MODELS VIA QUADRATIC APPROXIMATIONS Ph.D. Thesis
Robert Allan Isaacson 1975 200 p
Avail: Univ. Microfilms Order No. 75-16314

Two methods are presented for optimizing chemical process models which are modular in structure. These methods are characterized by the sequential use of local quadratic approximations to the objective and inequality constraint functions in order to generate feasible points in decision variable space having improved objective function values at each step. The methods are extensions of the method of approximation programming (MAP) to include second order effects of the decision variables. An example process problem, with twelve variables for optimization and four inequality constraints, is solved using quadratic approximation methods, as well as some other optimization methods (complex search, a variation of MAP, and penalty function with gradient projection). Quadratic approximation methods proved to be the most efficient for the optimization of the test model. Dissert. Abstr.

N75-32191*# Illinois Univ., Urbana.
THE CHARACTERIZATION AND EVALUATION OF ACCIDENTAL EXPLOSIONS
Roger A. Strehlow and Wilfred E. Baker (Southwest Res. Inst.) Jun. 1975 92 p refs
(Grant NsG-3008)
(NASA-CR-134779; UILU-ENG-75-0503; AAE-75-3) Avail: NTIS HC $4.75 CSCL 21B

Accidental explosions are discussed from a number of viewpoints. First, all accidental explosions, intentional explosions and natural explosions are characterized by type. Second, the nature of the blast wave produced by an ideal (point source or HE) explosion is discussed to form a basis for describing how other explosion processes yield deviations from ideal blast wave behavior. The current status blast damage mechanism evaluation is also discussed. Third, the current status of our understanding of each different category of accidental explosions is discussed in some detail. Author

N75-32192# Division of Mechanical Engineering, Ottawa (Ontario).
BOILING RANGE DISTRIBUTION OF PETROLEUM FRACTIONS BY GAS CHROMATOGRAPHY
G. Moon May 1975 23 p refs
(NRC-14790; ISSN-0077-555X; MP-68) Avail: NTIS

The application of an ASTM procedure, which utilizes gas chromatographic analysis, to the analysis of wide cut aviation turbine fuels was studied. Test results and comments on the procedure are included. Author

N75-32193# Pennsylvania State Univ., University Park. Dept. of Physics.
SPECTROSCOPY AND SCATTERING Final Report, 1 Jul. 1970 - 30 Nov. 1974
30 Nov. 1974 34 p refs
(Contract N00014-67-A-0385-0012)
(AD-A001798) Avail: NTIS CSCL 07/4

The authors' research on molecular spectroscopy and light scattering is summarized and two papers are presented. The first concerns temporary gratings on germanium, and the other discusses Rayleigh wing scattering on nitrobenzene. GRA

N75-32194# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHEMICAL AND PHYSICOCHEMICAL METHODS OF EVALUATING THE QUALITY OF CARBON BLACK
K. A. Pechkovskaya, P. N. Orlovskii, and S. A. Simonovskaya 6 Jan. 1975 21 p refs Transl. into ENGLISH from Kauchuk i Rezina (USSR), no. 3, 1957 p 28-32
(AD-A006842; FTD-HT-23-638-75) Avail: NTIS CSCL 07/4

Since rubbers contain other ingredients beside carbon black, it is difficult to evaluate the quality of the carbon black by analyzing vulcanzate of the rubber mixtures. A colorimetric technique (optical density of a suspended solution) for evaluating the quality of carbon black in rubbers is presented. Properties of the carbon black such as the degree of dispersion, structure, and nature of the surface are examined. J.R.T.

N75-32195# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORMATION OF SULFUR PARTICLES IN SOLUTIONS OF SODIUM THIOSULFATE BEHIND SHOCK WAVE FRONTS
O. B. Yakusheva, V. V. Yakushev, and A. N. Dremin 18 Nov. 1974 13 p refs Transl. into ENGLISH from the mono "Gorenie i Vzryv" Moscow, 1972 p 544-548
(AD-A002897; FTD-HT-23-1986-74) Avail: NTIS CSCL 07/4

The formation time for macroscopic particles of colloid dimensions in organic liquids behind a shock front will depend substantially on the properties of these liquids under shock compression conditions: kinetic decomposition parameters, viscosity of the medium, etc. Thus, to experimentally confirm the possibility of solid particles of colloid dimensions forming during visual observation time in shock-wave experiments (about one microsec) it was advantageous to study colloid formation in aqueous solutions since the properties of water under shock

compression have been rather thoroughly studied. Aqueous solutions of sodium thiosulfate were selected for these model experiments. It was assumed that if these solutions were subjected to shock compression behind the shock front colloid sulfur particles might form. The transparency of aqueous solutions Na2S2O3 under shock compression conditions was studied by employing a method of high-speed color photography. GRA

N75-32196# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BURNING OF LOW BOILING BINDER FROM PARTICLE OF A TWO-COMPONENT METAL-CONTAINING FUEL

A. A. Kossoi, E. S. Ozerov, and G. I. Sirkunen 5 Nov. 1974 13 p refs Transl. into ENGLISH from the mono. "Gorenie i Vzryv" Moscow, 1972 p 207-211

(AD-A001189; FTD-HT-23-1876-74) Avail: NTIS CSCL 21/2

A one dimensional problem was examined, and the heat exchange and mass exchange with the medium are described within the framework of a reduced film model. There is no reaction in the pores of the dry layer since the particle temperature during combustion of the vapors doesn't exceed the relatively low boiling temperature of the hydrocarbon. An homogeneous reaction of the second order occurs in the gas layer; it is assumed that the fields of concentrations and temperature in the reduced film and the fields of concentrations in the dry layer are quasi-stationary, while the physical constants of the gas mixtures are independent of temperature and its composition. Author

N75-32197# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON INDUCTION PERIOD DURING IGNITION OF DISPERSED SYSTEM

V. I. Lisitsk, A. A. Pirozhenko, and V. N. Vilyunov 12 Nov. 1974 15 p refs Transl. into ENGLISH from the mono "Gorenie i Vzryv" Moscow, 1972 p 186-190

(AD-A001153; FTD-HT-23-1871-74) Avail: NTIS CSCL 21/2

When a flow with a slight dust content moves along a tube whose walls are heated to 300-1400K radiation plays the greatest role in heat exchange. For this reason a subject worthy of attention is the plotting of approximate analytical dependences describing the ignition of a group of particles by a radiant energy flux or by hot surfaces. GRA

N75-32198# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TOWARD A THEORY ON THE COMBUSTION OF FUEL DROPLETS IN A STATIONARY MEDIUM AND IN A FLOW OF OXIDIZER

S. S. Rybanin 12 Nov. 1974 18 p refs Transl. into ENGLISH from the book "Gorenie i Vzryv" Moscow, 1972 p 212-220

(AD-A001155; FTD-HT-23-1877-74) Avail: NTIS CSCL 21/2

The authors examine a spherical fuel drop which burns in an unlimited gas medium - a mixture of an oxidizer and an inert component. The combustion process is quasi-stationary. The bimolecular chemical reaction between the fuel and the oxidizer occurs in the gas phase. GRA

N75-32199# Advanced Technology Labs., Inc., Westbury, N.Y.

IGNITION PHASE BLAST FIELD STUDY Interim Scientific Report, 15 Jan. 1975

John Erdos and John Ranlet Apr. 1975 33 p refs

(Contract F44620-74-C-0041; AF Proj. 9711)

(AD-A010480; ATL-TR-211; AFOSR-75-0714TR) Avail: NTIS CSCL 19/7

Evolution of the ignition phase blast field of a tube or silo launched rocket is described in terms of three distinct phases or steps. The first or precursor phase is associated with leakage of the high pressure gas (termed the launch gas) used to eject the rocket from the tube. The second phase occurs when the bulk of the launch gas is released as the rocket base clears the end of the tube. Both these steps are analogous to their counterparts in the muzzle blast of a conventional gun. However, the third, and probably most severe, phase in the subject problem accompanies ignition of the rocket motor and initial production of thrust. The present report describes work performed on two facets of the subject problem. The first is analysis of the internal gas flow during start of the launch. Particular attention is given to formation of the salient characteristics of the flow field which will affect the precursor phase of the blast field. Results of several numerical examples are presented to illustrate the properties of the internal flow field. The second facet of the problem which has been studied is the ignition-phase blast field, per se. GRA

N75-32200# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

USING THE MONTE-CARLO METHOD IN CHEMICAL KINETICS

S. N. Lebedev, V. B. Leonas, Yu. G. Malama, and A. I. Osipov 5 Nov. 1974 22 p refs Transl. into ENGLISH from the mono. "Gorenie i Vzryv" Moscow, 1972 p 702-711

(AD-A001852; FTD-MT-24-2015-74) Avail: NTIS CSCL 07/4

The contemporary kinetic theory of reacting gases is based on the solution to Boltzmann's equation. Since the reaction disturbs the equilibrium distribution, the problem consists of finding the non-equilibrium distribution function and the reaction rate which corresponds to this function. Although the direct numerical integration of Boltzmann's equation is possible, with the exception of the simplest cases it requires unacceptably high expenditures of machine time. In this situation attempts appear hopeful for using the Monte-Carlo method (MCM) for solving problems of gas kinetics and gas dynamics. In this article the discussion will concern the physical variety of the MCM which consists of the direct modeling of the sequence of elementary events of the particle interaction of the system studied on a computer. GRA

N75-32201# Argonne National Lab., Ill.

TRANSITION ENERGIES AND ELECTRONIC SPECTRA FOR THE NO2 SYSTEM Annual Report, Aug. 1973 - Sep. 1974

A. C. Wahl and G. Das 17 Sep. 1974 44 p refs Sponsored by AF

(AF Proj. 9767)

(AD-A010542; AFOSR-75-0616TR) Avail: NTIS CSCL 07/4

Ab initio calculations of higher accuracy than previously done have been performed on NO2. The improvements include the use of a basis set which is larger than was previously used, more extensive treatment of molecular correlation, and variation of bond lengths and angles for all the lowlying electronic states. The wavefunctions used in the computations were obtained by use of the Optimized Valence Configuration (OVC) multiconfigurational self-consistent field (MCSCF) methods of Das and Wahl. GRA

N75-32202# Emory Univ., Atlanta, Ga.

RECOMBINATION EMISSION IN HYDROGEN-FLUORINE SYSTEMS

P. S. Ganguli, B. L. Hertzler, and M. Kaufman 1 Apr. 1975 12 p refs

(Contract N00014-73-C-0219)

(AD-A010201) Avail: NTIS CSCL 07/4

Visible emission which is generated when H2 is added to partially dissociated F2 is found to be due to Delta V 4, 5, and 6 transitions of HF(X). The temporal and stoichiometric dependence of this emission strongly suggests that it results from atomic recombination. Author

N75-32203*# Scientific Translation Service, Santa Barbara, Calif.

INVESTIGATION OF THE ADSORPTION OF SULFOXIDES FROM DILUTE SOLUTIONS

G. D. Galpern, E. N. Karaulova, and T. S. Novozhilova Washington NASA Oct. 1975 12 p refs Transl. into ENGLISH from Tr. Inst. Nefti (USSR), v. 13, 1959 p 51-57

(NASA-TT-F-14798) Avail: NTIS HC $3.25 CSCL 07D

Quantitative data on the relative adsorbabilities of sulfoxides, solvents, and thiophene compounds are reported. Particular attention was given to adsorption from strongly diluted solutions. The following adsorption isotherms were obtained by statistical analysis: for benzene, chloroform, dibenzothiophene, dibenzylsulfoxide, and diphenylsulfoxide on silica gel from solutions in isooctane; for dibenzothiophene, dibenzylsulfoxide, and diphenylsulfoxide on silaca gel from benzene solutions; for benzene and diphenylsulfoxide on aluminum oxide from isooctane; for dibenzylsulfoxide and diphenylsulfoxide on silaca gel from benzene solutions; and for dibenzylsulfoxide and diphenylsulfoxide on aluminum oxide from benzene solutions. At the studied concentrations, the specific adsorption of benzene and chloro-

form was almost the same in silica gel. Dibenzothiophene is adsorbed best of these solvents. However, with an excess of an aromatic hydrocarbon, for example, from solutions in benzene, it is not adsorbed. Due to the very poor solubility of dibenzylsulfoxide and diphenylsulfoxide in isooctane, their adsorbability could not be compared with that of the aforementioned solvents and dibenzothiophene at equal equilibrium concentrations. Author

N75-32204# National Bureau of Standards, Washington, D.C. Chemical Kinetics Information Center.
SUPPLEMENTARY BIBLIOGRAPHY OF KINETIC DATA ON GAS PHASE REACTIONS OF NITROGEN, OXYGEN, AND NITROGEN OXIDES (1972-1973) Final Report
Francis Westley Jun. 1975 91 p refs Sponsored in part by Naval Ordnance Systems Command, Washington, D. C.
(COM-75-10687/2; NBS-SP-371-1; LC-726-00272) Avail: NTIS MF $2.25; SOD HC as C13.10:371-1 CSCL 07D

A reaction-oriented list of references is provided for papers and reports published in 1972 and 1973, containing rate data for reactions of N, N2, N2O, N2O2, N2O4, N2O4, N2O5, NO, NO2, NO3, NO4, O, O2 and O3 with each other. Some reactions of species in excited states are included. This bibliography, covering about 500 papers, extends the coverage of two previous bibliographies on the same subject. Some work published prior to 1972 omitted in the previous publications was included here. GRA

N75-32205# California Univ., San Diego. Dept. of Chemistry.
ENERGY PARTITIONING AND ASSIGNMENT OF EXCITED STATES IN THE ULTRAVIOLET PHOTOLYSIS OF HI AND DI
Robert D. Clear, Stephen J. Riley, and Kent R. Wilson Oct. 1974 42 p refs
(Contract N00014-69-A-0200-6020)
(AD-A002227) Avail: NTIS CSCL 07/5

Photofragment spectroscopy has been applied to the photolysis of hydrogen iodide and deuterium iodide at 37 550/cm (266.2 nm). The extent of excited I (doublet P(1/2)) atom production and the symmetry of the excited molecular states leading to dissociation are derived by measuring the translational energy and angular distributions of the recoiling H and D atoms. A non-linear curve fitting technique is applied to the available data to separate each state's contribution to the total continuum absorption, and to provide estimates of the shape of each excited state potential energy curve. GRA

N75-32206# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
HADAMARD MATRICES IN SPECTROSCOPY
G. A. Vanasse 28 May 1975 21 p refs Presented at Proc. of 1974 Symp. on Appl. of Walch Functions and Sequency Theory
(AF Proj. 8603)
(AD-A010436; AFCRL-TR-75-0300) Avail: NTIS CSCL 07/4

Parameters determining the efficiency of spectrometric systems (like resolution, light-gathering capability, etc.) are discussed briefly. The multiplex principle as applied in spectroscopy is outlined and the most popular method of multiplexing in spectroscopy (Fourier spectroscopy) is presented. The role of modified Hadamard matrices in spectroscopy is outlined and a comparison between Fourier and Hadamard spectroscopy is presented from the point of view of efficiency, ease of implementation and limitations. GRA

N75-32207# Sussex Univ., Brighton (England). School of Molecular Sciences.
INORGANIC PHOTOELECTRON SPECTROSCOPY, MASS SPECTROMETRY AND THERMOCHEMISTRY RELATED TO FUELS Final Report, 1 Jan. 1972 - 31 Dec. 1974
M. F. Lappert and J. B. Pedley Apr. 1975 40 p refs
(Grant AF-AFOSR-2220-72; AF Proj. 9536; AF Proj. 6813)
(AD-A010507; AFOSR-75-0669TR) Avail: NTIS CSCL 07/4

Compounds of boron, silicon, phosphorus, and some of the other Group III and IV elements, as well as transition metals have investigated by various thermochemical and spectroscopic methods in order to derive basic parameters such as standard heats of formation and molecular orbital binding energies. Experimental methods have relied on calorimetry, computer analysis of thermochemical data, mass spectrometry, U.V. and X-ray excitation-photoelectron, nuclear magnetic resonance, electron spin resonance, and Mossbauer spectroscopy. Results have been analyzed by molecular orbital theory. GRA

N75-32208# Westinghouse Research Labs., Pittsburgh, Pa.
FLUIDIZED BED COMBUSTION PROCESS EVALUATION (PHASE 1: RESIDUAL OIL GASIFICATION/ DESULFURIZATION DEMONSTRATION AT ATMOSPHERIC PRESSURE). VOLUME 1: SUMMARY Report for May 1973 - Dec. 1974
D. L. Keairns, R. A. Newby, E. J. Vidt, E. P. ONeill, and C. H. Peterson Mar. 1975 133 p refs
(Contract EPA-68-02-0605)
(PB-241834/1; EPA-650/2-75-027-a-Vol-1) Avail: NTIS HC $5.75 CSCL 07A

Results are summarized of an evaluation of an atmospheric-pressure fluidized bed residual oil gasification/desulfurization process, as the chemically active fluidized bed (CAFB) process. The (CAFB) produces a clean, low heating value fuel gas for firing in a conventional boiler. The integrated process, demonstrated the ability to meet environmental emission standards for sulfur oxides, nitrogen oxides, and particulates. Process flow diagrams, energy and material balances, equipment specifications, vessel drawings, equipment arrangement drawings, a site plan, an electrical one-line drawing, and utility requirements are presented for the recommended process concept. Plant performance, environmental impact, and functional operating conditions are presented and development requirements identified. Capital and operating costs are presented for the 50 MW demonstration plant and for commercial plants with capacities from 50 to 500 MW. Limestone sorbent support data is given. GRA

N75-32209# Westinghouse Research Labs., Pittsburgh, Pa.
FLUIDIZED BED COMBUSTION PROCESS EVALUATION (PHASE 1: RESIDUAL OIL GASIFICATION/ DESULFURIZATION DEMONSTRATION AT ATMOSPHERIC PRESSURE). VOLUME 2: APPENDICES Report for May 1973 - Dec. 1974
D. L. Keairns, R. A. Newby, E. J. Vidt, E. P. ONeill, and C. H. Peterson Mar. 1975 420 p refs
(Contract EPA-68-02-0605)
(PB-241835/8; EPA-650/2-75-027-b-Vol-2) Avail: NTIS HC $10.50 CSCL 07A

Appendices are presented from an evaluation of an atmospheric-pressure fluidized bed residual oil gasification/desulfurization process, the chemically active fluidized bed (CAFB) process. Appendices are entitled: market data; preliminary design process description; demonstration plant site; fluidized bed oil gasification demonstration plant design basis; design manual; boiler modifications; environmental impact; commercial plant design; initial design study; evaluation and selection of reaction system process and design options; spent stone processing options; dry sulfation experimental program; slurry recarbonation experimental program; acid sulfation experimental program; dry recarbonation and sintering experimental programs; sulfur recovery system design and evaluation; limestone selection; thermogravimetric studies on the sorbtion of sulfur by lime; and spent limestone disposition. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N75-32210 Columbia Univ., New York.
ULTRASONIC STUDY OF MICROPLASTICITY IN ALPHA-BRASS Ph.D. Thesis
Min-Chung Jon 1975 156 p
Avail: Univ. Microfilms Order No. 75-18393

A high amplitude ultrasonic apparatus was utilized to study how the variation with amplitude of internal friction 1/q modulus defect (delta S/S) sub t, and harmonic amplitudes A sub n in alpha brass are influenced by variations in composition, grain size, and dislocation substructure. To explain the observations of internal friction, modulus defect and harmonic generation, a

dislocation model based on the Frank-Read source operation is proposed. Each region can be ascribed to a different stage of the source operation; a detailed discussion in terms of experimental results is presented. Dissert. Abstr.

N75-32211 Florida Univ., Gainesville.
INITIATION AND PROPAGATION OF PITTING IN ALUMINUM IN CHLORIDE SOLUTIONS Ph.D. Thesis
Shantanu Maitra 1974 224 p
Avail: Univ. Microfilms Order No. 75-19356

The effects of some known electrochemical variables were characterized for the pitting process in order to provide a basis for distinguishing between the initiation and propagation stages of pitting, so that each could be evaluated separately. The effect of bulk anionic concentrations on the onset and breakdown of passivity was studied, and then related to the results of variations of characteristic potentials, which were obtained by the electrochemical hysterisis technique. The results indicate that passivity is strongly affected by the nature and concentration of aggressive as well as nonaggressive anions in bulk solution. Variations in pitting potentials as functions of several variables suggest that pit initiation is strongly dependent on the rate of adsorption of anions on the oxide surface. Adsorption and subsequent penetration of anions in the oxide was investigated by Auger electron microscopy. Results show that significant adsorption and penetration of chloride ions does occur, and is affected by the concentrations of passivating species in solution. Dissert. Abstr.

N75-32212 Columbia Univ., New York.
METAL VAPOR CONDENSATION UNDER HIGH PRESSURE Ph.D. Thesis
Shing-Cheng Hsieh 1975 191 p
Avail: Univ. Microfilms Order No. 75-18387

Mercury vapor up to 500 psia was condensed outside a cylindrical tube in both horizontal and vertical positions. The results show consistently low heat transfer coefficients when compared with Nusselt's theory. Two auxiliary mercury vapor condensers located downstream of the boiler vent were used to control and safeguard the system. The results obtained furnish technical data for the direct application of mercury vapor condenser design, and also clarify some uncertainties in the particular field of metal vapor condensation. It is concluded that the lower-than-usual heat transfer coefficients of metal vapor condensation could not be caused by the noncondensable gas remaining in the boiler chamber. It is hypothesized that dimer content in the metal vapor phase behaves as noncondensable or semi-condensable gas and creates a diffusional barrier at the vapor-liquid interface near the condensate film. This dimer vapor causes interfacial resistance during metal vapor condensation process.
Dissert. Abstr.

N75-32213 Case Western Reserve Univ., Cleveland, Ohio.
RADIATION ENHANCED PRECIPITATION IN Al-4 PERCENT Cu BY HIGH VOLTAGE ELECTRON MICROSCOPY Ph.D. Thesis
Philip Stephen Sklad 1975 128 p
Avail: Univ. Microfilms Order No. 75-19247

The effect of electron irradiation on the precipitation behavior of an Al-4% Cu alloy was investigated using high voltage electron microscopy. High flux irradiation at room temperature was observed to be effective in producing interstitial dislocation loops in both solution-treated specimens and aged specimens. The behavior of these loops is consistent with the behavior of similar loops observed in pure aluminum by other investigators. In addition the irradiation was effective in reducing the number of G. P. zones present. This effect is discussed in terms of: (a) the instability which occurs when vacancies necessary for the formation of the zones are annihilated by irradiation-produced interstitials, (b) the disordering of the zones by the mixing action of the irradiation, or (c) a decrease in the stability of zones which accompanies the irradiation enhanced appearance of the more stable theta prime phase. Dissert. Abstr.

N75-32214 Case Western Reserve Univ., Cleveland, Ohio.
ELECTRON IRRADIATION DAMAGE IN COPPER AND VANADIUM Ph.D. Thesis
Edward Alan Kenik 1974 168 p
Avail: Univ. Microfilms Order No. 75-19219

Electron irradiation damage studies were performed on thin foils of pure copper and UHV outgassed vanadium in a high voltage electron microscope. Threshold energies in both metals were determined for the three primary directions from the accelerating voltage required for the formation of visible clusters. Significant subthreshold damage was observed in copper for [100] and [111] irradiations. This damage was attibuted to series collision mechanism involving interstitial hydrogen. In comparing the threshold energies determined for copper and vanadium, it was observed that the orientation dependence of the threshold energy for bcc metals differs from that for fcc metals. Identification and analysis of the defect clusters formed during irradiation were performed. In copper, both small and large dislocation loops were identified as interstitial Frank loops while a complex loop growth sequence was suggested for vanadium. The effects of foil thickness, electron flux, temperature, and deformation of the formation of voids were investigated. Dissert. Abstr.

N75-32215 Case Western Reserve Univ., Cleveland, Ohio.
MECHANICAL PROPERTIES AND DISLOCATION SUBSTRUCTURE IN TANTALUM-RHENIUM-NITROGEN ALLOYS Ph.D. Thesis
John Allen Shields, Jr. 1975 239 p
Avail: Univ. Microfilms Order No. 75-19245

High purity Ta and Ta-Re alloy single crystals were grown by electron-beam zone melting and purified using UHV annealing techniques. These crystals, along with identical alloys doped with a constant background of approximately 300 ppma N, were tested in tension at 77K. Electron microscopy was used to investigate the dislocation substructures evolved as a function of alloy content. Specimens containing only one solute exhibited only alloy hardening, while those containing two solutes exhibited alloy softening. The addition of either N or Re to Ta results in a reduction of secondary dislocation and debris density, and an increase in primary dislocation density. Purified Ta specimens having various orientations were deformed in both tension and compression at 4.2K. Adiabatic slip was the dominant mode of deformation in tension. The addition of up to 4% Re to Ta eliminates twinning at 77K, and promotes the occurrence of slip at 4.2K for orientations displaying only twinning in unalloyed specimens. Dissert. Abstr.

N75-32216 Wisconsin Univ., Madison.
THE EFFECT OF COMPOSITIONAL AND PROCESS VARIABLES ON THE OCCURRENCE OF THE INTERGRANULAR FRACTURE OF CAST STEEL Ph.D. Thesis
Salah Eldin Mahmoud 1975 190 p
Avail: Univ. Microfilms Order No. 75-16319

Compositional variables included aluminum, boron, titanium, and zirconium contents, and the process variables investigated were pouring temperature, cooling rates, ahd heat treatment. In order to best investigate the effect of these variables on the occurrence of intergranular fracture, a statistical design was employed in which each variable was studied at two levels. The test bars were heat treated in such a way to obtain fracture surfaces in the as-cast as well as after normalizing, normalize and temper, as-quenched, and quenched and tempered to three hardness levels. The results can be divided into two groups: the first is the statistical and macroscopic approach which enabled defining the conditions leading to maximum susceptibility to intergranular fracture; the second approach was identification of the embrittling constituents which are believed to be associated with intergranular fracture. The susceptibility to intergranular fracture is dependent upon composition of the steel, process variables, relative strength of the matrix with respect to grain boundary, and size, distribution, and morphology of the embrittling constituent. Dissert. Abstr.

N75-32217 Ohio State Univ., Columbus.
THE EFFECTS OF HYDROGEN ON SLIP AND TWINNING IN PURE TITANIUM SINGLE CRYSTALS Ph.D. Thesis
John Wei Fu 1975 137 p
Avail: Univ. Microfilms Order No. 75-19438

Two purities of pure titanium single crystals were used; from these materials single crystal cubes with pre-determined orientations were prepared. These cubes were charged with different amounts of hydrogen. The hydrogenation method was

gaseous charging at elevated temperatures. These cubes were compressed using an Instron machine and load-displacement curves were recorded; critical resolved shear stresses of slip systems and twinning system were calculated. Identification of the twin planes and slip planes was done using traces analysis on two surfaces of the cube. The results show that hydrogen, oxygen, and nitrogen increase critical resolved shear stresses of the slip systems and decrease critical resolved shear stress of the /11(-2)2/<11(-2)3> twinning system. The role of twinning in embrittlement mechanism is fully discussed. It is thought that twinning with its highly concentrated strain will enhance any existing embrittlement mechanism. A stress corrosion cracking model is presented which explains the fracture facets observed in transgranular stress corrosion cracking of alpha titanium.
Dissert. Abstr.

N75-32218 Tennessee Univ., Knoxville.
AN INVESTIGATION OF ALLOYING EFFECTS IN ALUMINUM DISPERSION STRENGTHENED WITH Al2O3 Ph.D. Thesis
George Larry Copeland 1975 117 p
Avail: Univ. Microfilms Order No. 75-18951

Two types of alloying elements were investigated to determine if the room-temperature strength could be improved and if, through lowering the oxide content, the high-temperature ductility could be improved. Magnesium was investigated for its solid solution strengthening in one type alloy. The other type alloy involved further dispersion strengthening through adding the elements iron, molybdenum, zirconium, chromium, vanadium, and titanium which form highly stable intermetallic compounds with aluminum. To evaluate the effects of the alloying, fabrication techniques were developed which produced uniform and reproducible rods for testing. Prealloyed powders were produced by atomizing the molten alloys and collecting the powders in water. This procedure produced uniform powders with a very fine distribution of the intermetallic compounds. Fabrication into rods included ball-milling, vacuum hot pressing, vacuum heat treating, and hot extrusion.
Dissert. Abstr.

N75-32219 Michigan Univ., Ann Arbor.
LAGRANGIAN KINEMATICS IN THE PLANE-STRAIN EXTRUSION OF A REAL METAL Ph.D. Thesis
William Herbert Ginman 1975 178 p
Avail: Univ. Microfilms Order No. 75-20351

A kinematic investigation is presented of the direct cold plane-strain extrusion process. The deformations are described in terms of the differences in the path lines for the flow of 6061-0 aluminum through tapered dies as compared to an ideal flow. Actual deformations are also compared to the deformations predicted by the slip line theory. The deformations were determined experimentally by examining the changes in a grid pattern that is marked on the halves of a split billet before extrusion. Two different die angles and reductions in area were investigated. A measure of the rotationality of the aluminum flow field was determined, and an analytical model is created for the actual velocity field. The deformations predicted by the analytical model of the actual velocity field are compared to the actual deformations.
Dissert. Abstr.

N75-32220 American Univ., Washington, D.C.
THE HEAT CAPACITY OF MAGNETITE NEAR THE METAL-SEMICONDUCTOR TRANSITION POINT Ph.D. Thesis
James Robert Wolf 1975 137 p
Avail: Univ. Microfilms Order No. 75-18571

Recent experimental results show that the Verwey ionic hopping model provides an inadequate explanation of the metal-insulator transition in magnetite. A three order parameter, multiple ordering theory for magnetite predicts the possibility of other phase transitions in the region surrounding the Verwey transition. Heat capacity measurements using the recently developed ac heat capacity technique were made on natural and synthetic crystals of magnetite to determine if additional anomalies were present. The natural crystal exhibited only one peak which was located at 117.77 K. In the synthetic samples, two separate and pronounced peaks were observed. One was located at 112.95 K and the other at the normal Verwey temperature of 118.59 K. This low temperature peak gives additional experimental support that the multiple ordering theory is an accurate description of the metal-insulator in magnetite.
Dissert. Abstr.

N75-32221 Kentucky Univ., Lexington.
DEFORMATION KINETICS AND VISIOPLASTICITY ANALYSIS OF AXISYMMETRICALLY HOT EXTRUDED 2024 ALUMINUM ALLOY AND SELECTED TITANIUM ALLOYS Ph.D. Thesis
Carl Phillip Hinesley 1974 280 p
Avail: Univ. Microfilms Order No. 75-18486

The effects of temperature and ram speed on the flow patterns of axisymmetric extrusions were investigated for 2024 Al alloy, a commercially pure grade of titanium (Ti-50A), an alpha titanium alloy (Ti-5Al-2.5Sn) and an alpha + beta titanium alloy (Ti-6Al-4V). The ram speed was varied from 300 to 537 C for the 2024 Al alloy and from 537 to 925 C for the titanium materials. In addition to the common flow pattern consisting of a single maximum in the transverse grid lines located at the extrusion axis, there resulted new double maximum pattern, which occurred to different degrees. A continuous spectrum of flow patterns was observed between the extremes of the accentuated double and single maximum flow patterns. Both the type and the degree of the flow patterns were found to be a function of temperature and ram speed with these parameters being inversely related.
Dissert. Abstr.

N75-32222 Waterloo Univ. (Ontario). Solid Mechanics Div.
FATIGUE STUDIES OF OFHC COPPER AND A COPPER DISPERSION ALLOY AT 300-750 DEG C
G. J. Cocks (Adelaide Univ.) and D. M. R. Taplin May 1975 29 p refs Submitted for publication
(Paper-135) Avail: Issuing Activity

High strain, low-cycle fatigue tests were carried out for two copper metals. The influence of test temperature and strain amplitude on fatigue life was investigated. Results indicate that low temperatures and high strain amplitudes favor an intragranular failure mode. However, at 490 C and at low strain amplitudes, failure occurs by the nucleation, growth and interlinkage of grain-boundary cracks. Under these conditions, the fatigue life of the dispersion alloy based on cycles to failure is higher than that of oxygen free high conductivity (o.f.h.c.) copper. The extent of grain-boundary sliding and cracking is greater in o.f.h.c. copper, than in the dispersion alloy. The rate of migration in o.f.h.c. copper depends upon strain amplitude. Migration of boundaries to orientations at 45 deg to the applied stress direction appears to be a consequence of grain-boundary sliding rather than being determined by the morphology of dislocation networks within the grains.
Author

N75-32223 Waterloo Univ. (Ontario). Solid Mechanics Div.
EFFECT OF GRAIN SIZE ON THE TENSILE PROPERTIES OF A Cr-Mn-N AUSTENITIC STAINLESS STEEL IN THE TEMPERATURE RANGE 25 TO 1000 C
V. V. Kutumbarao, P. Rama Rao, and D. M. R. Taplin Oct. 1973 52 p refs Presented at Spring Meeting of AIME/ASM, Philadelphia, 30 May 1973 Submitted for publication
(Paper-122) Avail: Issuing Activity

In tensile tests at a constant nominal strain rate of 1/3.6 hr, flow stress increased with decreasing grain size (d) at temperatures up to 600 C in accordance with the Hall-Petch relationship. At temperatures above 600 C, a reversal occurs in the flow stress versus grain size relationship and the strength decreases with decreasing grain size. The variation of ductility with temperature in slow strain rate tensile tests was marked by a minimum at about half the absolute melting temperature. Fracture in the vicinity of 0.5 melting temperature and above involved cavitation at grain boundaries as well as at precipitate/matrix interfaces. A decrease in grain size generally enhanced ductility in this situation, but at fine grain sizes, this effect was reversed due to microstructural instability. A quantitative metallographic study of the fractured specimens with a range of initial grain sizes suggested that the final fracture process is governed by a critical crack dimension criterion.
Author

N75-32224*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SEVERAL BRAZE FILLER METALS FOR JOINING AN OXIDE-DISPERSION-STRENGTHENED NICKEL-CHROMIUM-

ALUMINUM ALLOY

Charles A. Gyorgak Washington Sep. 1975 22 p refs
(NASA-TN-D-8064; E-8379) Avail: NTIS HC $3.25 CSCL 11F

An evaluation was made of five braze filler metals for joining an aluminum-containing oxide dispersion-strengthened (ODS) alloy, TD-NiCrAl. All five braze filler metals evaluated are considered suitable for joining TD-NiCrAl in terms of wettability and flow. Also, the braze alloys appear to be tolerant of slight variations in brazing procedures since joints prepared by three sources using three of the braze filler metals exhibited similar brazing characteristics and essentially equivalent 1100 C stress-rupture properties in a brazed butt-joint configuration. Recommendations are provided for brazing the aluminum-containing ODS alloys. Author

N75-32225*# Pratt and Whitney Aircraft, East Hartford, Conn.
EVALUATION OF POWDER METALLURGY SUPERALLOY DISK MATERIALS

D. J. Evans Aug. 1975 133 p refs
(Contract NAS3-15841)
(NASA-CR-134865; PWA-5263) Avail: NTIS HC $5.75 CSCL 11F

A program was conducted to develop nickel-base superalloy disk material using prealloyed powder metallurgy techniques. The program included fabrication of test specimens and subscale turbine disks from four different prealloyed powders (NASA-TRW-VIA, AF2-1DA, Mar-M-432 and MERL 80). Based on evaluation of these specimens and disks, two alloys (AF2-1DA and Mar-M-432) were selected for scale-up evaluation. Using fabricating experience gained in the subscale turbine disk effort, test specimens and full scale turbine disks were formed from the selected alloys. These specimens and disks were then subjected to a rigorous test program to evaluate their physical properties and determine their suitability for use in advanced performance turbine engines. A major objective of the program was to develop processes which would yield alloy properties that would be repeatable in producing jet engine disks from the same powder metallurgy alloys. The feasibility of manufacturing full scale gas turbine engine disks by thermomechanical processing of pre-alloyed metal powders was demonstrated. AF2-1DA was shown to possess tensile and creep-rupture properties in excess of those of Astroloy, one of the highest temperature capability disk alloys now in production. It was determined that metallographic evaluation after post-HIP elevated temperature exposure should be used to verify the effectiveness of consolidation of hot isostatically pressed billets. Author

N75-32226# Army Foreign Science and Technology Center, Charlottesville, Va.
DETERMINATION OF THE DYNAMIC YIELD POINT IN SHEET METALS DURING BIAXIAL EXTENSION

M. A. Galaburda 27 Aug. 1974 18 p refs Transl. into ENGLISH from Mono. Issled. Protsessov Plastich. Techeniya Metallov (Moscow), 1971 p 120-130
(AD-A009351; FSTC-HT-23-714-74) Avail: NTIS CSCL 11/6

The article discusses theoretically and tests experimentally a method for determining the dynamic yield point in sheet metals subjected to biaxial tension. The method can be applied to membranes under impulsive loads. GRA

N75-32227# Imperial Coll. of Science and Technology, London (England). Dept. of Metallurgy and Materials Science.
PRE-EXPOSURE EMBRITTLEMENT AND STRESS CORROSION FAILURE IN HIGH STRENGTH Al-Sn-Mg ALLOYS Final Technical Report, 12 Jan. 1974 - 11 Jan. 1975

Geoffrey M. Scamans, Reza Alani, and Peter R. Swann Feb. 1975 29 p refs
(Grant DA-ERO-124-74-G0033; DA Proj. D01-61102-B-32D)
(AD-A010491) Avail: NTIS CSCL 11/6

It has been found that a high purity Al-6%Zn-3%Mg alloy becomes embrittled if pre-exposed to moist gases prior to tensile testing. The degree of embrittlement increases with the time of pre-exposure and with the temperature and relative humidity of the pre-exposure environment. The alloy is most sensitive to embrittlement when solution treated at 475C but this sensitivity can be reduced considerably if the surface film formed at 475C is removed by electropolishing. The embrittlement is not strain rate sensitive and the ductility of the pre-exposed alloy cannot be recovered by storing unstressed in dry air or in vacuo. However, the ductility of embrittled specimens can be fully restored if tensile testing is carried out under vacuum. If 1.7% copper or 0.14% chromium are added to the high purity alloy the rate of embrittlement is reduced and is even more reduced in the commercial 7075 alloy. GRA

N75-32228# Naval Research Lab., Washington, D.C.
MODIFICATION OF E-DEP-1 TO RUN FOR HIGH ENERGY HELIUM IONS IN NICKEL AND TYPE-316 STAINLESS STEEL Final Memorandum Report

George P. Mueller and J. Edward Westmoreland Mar. 1975 31 p refs
(NRL Proj. NO1-23)
(AD-A010512; NRL-MR-3019) Avail: NTIS CSCL 11/6

The computer program E-DEP-1, 5 May 1973 version, has been modified to calculate the energy deposition of high energy helium ions in nickel and type-316 stainless steel. Calculations for 70-MeV He on Ni and on type-316 stainless steel were performed, and the resulting output is included in the form of two appendices. This effort provided the values needed to aid in the design of a joint Radiation Technology Division and Engineering Materials Division experiment to simulate radiation induced creep in reactor materials by helium ion bombardment. GRA

N75-32229# Naval Ship Research and Development Center, Bethesda, Md.
MECHANICAL, CORROSION, AND FATIGUE PROPERTIES OF 15-5 PH, ICONEL 718, AND RENE 41 WELDMENTS

Harvey P. Hack May 1975 44 p refs
(AD-A010468; NSRDC-4528) Avail: NTIS CSCL 13/10

Weldments of three hydrofoil strut/foil candidate materials (15-5 PH stainless steel, Inconel 718, and Rene 41) for hydrofoils were prepared. Mechanical, fatigue, corrosion fatigue, and corrosion tests were performed on these materials with various postweld heat treatments. Results of tensile, impact fatigue, stress corrosion, general corrosion, and crevice corrosion tests are presented. Weld procedures, problems, and machining difficulties are noted. The corrosion properties of Rene 41 and Inconel 718 are superior to 15-5 PH stainless steel; however difficulty in welding and machining these nickelbase alloys in thick sections make their application to hydrofoils highly unlikely without further development. Although not performing as well in seawater as the other two alloys, 15-5 PH is considerably easier to fabricate and therefore warrants consideration for hydrofoil struts and foils. GRA

N75-32230# Maryland Univ., College Park. Engineering Materials Group.
INVESTIGATION OF THE DUCTILE-BRITTLE TRANSITION FOR CERTAIN BCC AND HCP METALS Final Report, Oct. 1969 - Jun. 1974

R. W. Armstrong Apr. 1975 11 p refs
(Contract N00014-67-A-0239-0011; NR Proj. 031-739)
(AD-A009935) Avail: NTIS CSCL 11/6

The general purpose of this research program has been two-fold: (1) to determine the brittle fracture characteristics, mainly, of several steel and titanium materials; and, (2) to develop via appropriate constitutive relations a detailed description of the ductile-brittle transition behaviour which is exhibited by certain BCC and HCP metals. The brittle fracture behaviour of these materials was directly measured by tensile testing at 4.2K. Compression tests at 4.2K were performed, also, so as to establish the nature of whatever plastic deformation behaviour might be induced in the absence of applied tensile stresses. GRA

N75-32231# Maryland Univ., College Park. Engineering Materials Group.
THE STRENGTHENING OF HEXAGONAL CLOSE-PACKED MATERIALS DUE TO THE PRESENCE OF GRAIN BOUNDARIES Technical Report, Apr. 1973 - Jun. 1974

Y. V. R. K. Prasad, N. M. Madhava, and R. W. Armstrong Jan. 1975 13 p
(Contract N00014-67-A-0239-0011; NR Proj. 031-739)
(AD-A009938; EMG-158) Avail: NTIS CSCL 11/6

The grain size, temperature and strain rate dependences of

the stress-strain behavior of polycrystalline hcp metals are analyzed on the basis of a combined Hall-Petch and thermal activation strain rate analyses. The polycrystal parameters are related to single crystal resolved stresses and it is shown that the temperature dependence of Hall-Petch slope k sub epsilon is responsible for the grain size dependence of the strain rate sensitivity and ductile-brittle transition. The flow and fracture behavior of polycrystalline zinc and titanium at 4.2K provided an interesting comparison of the near-brittle failure of zinc as compared with the near-ductile fracture of titanium. GRA

N75-32232# Naval Postgraduate School, Monterey, Calif.
THERMOMECHANICAL CHARACTERISTICS OF NITINOL M.S. Thesis
John Michael Johnson Mar. 1975 68 p
(AD-A009986) Avail: NTIS CSCL 11/6

The flow stress of a common shape memory alloy, a particular alloy of nitinol, is investigated and presented as a function of temperature and strain. The reversion stress, that stress necessary to maintain a constant strain as a result of a martensitic phase transforming to the parent phase, is presented as a function of temperature and amount of prestrain. This reversion stress is demonstrated to approximate, during the cooling process, the flow stress. The stability of the reversion stress is investigated and is presented as a function of time at 220 C. A model of a shipboard device using a shape memory alloy is constructed and studied to compare with pure tensile data. GRA

N75-32233# Texas A&M Univ., College Station. Dept. of Chemistry.
UNUSUAL METALLOPORPHYRINS
Minoru Tsutsui and Chang-Po Hrung 1975 17 p refs
(Contract N00014-68-A-0308-0006; NR Proj. 356-559)
(AD-A006681; TR-8) Avail: NTIS CSCL 07/3

The chemistry of unusual metalloporphyrins is reviewed. Various transition metal complexes, including carbonyl compounds are discussed. Structures are included. GRA

N75-32234# Syracuse Univ., N.Y. Dept. of Chemical Engineering and Materials Science.
THE SIGNIFICANCE OF MATERIAL DUCTILITY TO THE RELIABILITY AND LOAD CARRYING CAPACITY OF PEAK PERFORMANCE STRUCTURES Final Report, 1 Jan. 1973 - 31 May 1974
Volker Weiss, M. Sengupta, and W. Sanford Jun. 1974 110 p refs
(Contract N62269-73-C-0261)
(AD-A010156; MS-VW-1708-F674) Avail: NTIS CSCL 11/6

Biaxial ductility test on aluminum 7050 - T73651 and 2014-T6 showed that aluminum alloys follow the predictions of the volume strain fracture criterion, i.e. the fracture ductility decreased monotomically from the uniaxial stress state to plane strain to balanced biaxial condition. No such conclusion was possible for the steels. A miniature bulge test fixture was designed, built and tested following Azrin and Backofen. In comparison to all the ductility test methods studied, the hydraulic bulge test maintains the initial stress state to failure for most materials while necking generally intervenes before fracture for the three biaxial tests. The hydraulic bulge test is, therefore, proposed for use in fracture toughness, ductility, correlation work. Based on the authors proposed correlation between fracture resistance and local fracture strain, a method for analytical predictions of the thickness effect on fracture toughness is presented. GRA

N75-32235# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
A LASER INTERFEROMETRIC TECHNIQUE FOR CRACK SURFACE DISPLACEMENT MEASUREMENT
William N. Sharpe, Jr. and Alten F. Grandt, Jr. Jul. 1974 33 p refs
(AF Proj. 7351)
(AD-A001621; AFML-TR-74-75) Avail: NTIS CSCL 11/6

The opening of a fatigue crack in an aluminum specimen was measured by optical interference from single grooves ruled on both sides of the crack. Displacement can be measured with a sensitivity of 0.1 micron, making the technique particularly useful in studies of crack closure. Details of this easy, inexpensive technique are discussed in this report. GRA

N75-32236# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
KINETIC LAWS OF THE TOPOCHEMICAL PROCESSES OF DIFFERENT TYPES
G. M. Zhabrob and B. M. Kadenatsi 31 Oct. 1974 21 p refs Transl. into ENGLISH from "Problemy Kinetiki i Kataliza. 25: Mekhanizm i Kinetika Geterogennykh Reaksii" Moscow, 1973 p 175-183
(FTD Proj. T74-04-08)
(AD-A001851; FTD-MT-24-1766-74) Avail: NTIS CSCL 07/2

The investigation studied a number of topochemical processes of the type A(solid) yields B(solid) gas. The specific reactions studied included the processes of decomposition of the hydrated oxylates of the different metals: magnesium, manganese, thorium, calcium, iron, nickel, cobalt and copper. GRA

N75-32237# Battelle Columbus Labs., Ohio.
THE PREPARATION OF MODIFIED NITINOL ALLOYS Final Report
D. C. Drennan and C. M. Jackson 25 Mar. 1974 16 p
(Contract N60921-74-C-0172)
(AD-A010497) Avail: NTIS CSCL 11/6

To provide material for use in a corrosion research program, the Naval Ordnance Laboratory contracted with Battelle's Columbus Laboratories to prepare large research samples of plate of six Nitinol alloys. Using melting procedures developed earlier by Battelle-Columbus, six 65-pound ingots were vacuum-induction melted and cast at Battelle-Columbus. All six ingots were found to be free of secondary pipe and porosity. The chemical compositions of five of the alloys are very close to the aim compositions; that of the sixth alloy differs somewhat, but should be satisfactory for the intended use. GRA

N75-32238# Naval Postgraduate School, Monterey, Calif.
TRANSMISSION ELECTRON MICROSCOPIC STUDIES OF SHAPE MEMORY STRUCTURES M.S. Thesis
Robert Ripley Allen Mar. 1975 37 p refs
(AD-A009967) Avail: NTIS CSCL 11/6

The reverted microstructure of equiatomic NiTi is characterized for several thermal and thermomechanical situations. The generation of dislocations is shown to occur in the martensite as well as the matrix. The debris left after reversion indicates several structures act together to bring about the conditions required for Shape Memory Effect. The nature of this interaction is affected by prior thermal history. GRA

N75-32239# Negev Univ., Beersheva (Israel). Dept. of Physics.
NUCLEAR MAGNETIC RESONANCE STUDY OF THE ROLE OF ALLOYING ON THE BEHAVIOR OF HYDROGEN IN METALS Final Scientific Report, 1 May 1972 - 30 Apr. 1974
David Zamir and C. Korn Feb. 1975 86 p refs
(Grant AF-AFOSR-2310-72; AF Proj. 7351)
(AD-A009960) Avail: NTIS CSCL 11/6

In this study, nuclear magnetic resonance (NMR) measurements were carried out on the Ti-H system in order to contribute to an understanding of the electronic structure and physical properties of this transition metal hydride. The nuclear spin-lattice relaxation time of hydrogen in titanium hydride was measured as a function of temperature and hydrogen concentration in a temperature region where the primary relaxation mechanism is due to the conduction electrons. A phenomenological model of the electronic structure of the Ti-H system and the role of hydrogen was formulated in order to explain the data and to correlate physical properties of the metal hydride with the proposed model. GRA

N75-32240# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
STRESS-CORROSION CRACKING OF METALLIC MATERIALS. PART 3: HYDROGEN ENTRY AND EMBRITTLEMENT IN STEEL Final Report, 15 Dec. 1968 - 31 Oct. 1971
Mars G. Fontana and Roger W. Staehle Apr. 1975 191 p refs
(Contract F33615-69-C-1258; AF Proj. 7312)
(AD-A010265; AFML-TR-72-102-Pt-3) Avail: NTIS CSCL 11/6

The chemical environment and metallurgical structure play important roles in the entry of hydrogen into iron and steel. In particular, the effect of compounds of sulfur, arsenic, phosphorus, selenium, and other elements, generally called cathodic poisoners, is considered. The role of pH, electrochemical potential, stress, and temperature on the hydrogen entry kinetics is also considered. Metallurgical factors that influence the hydrogen entry and permeation rates include the alloy composition (substitutional and interstitial atoms), annealing and tempering (temperature, time), grain size, and the microstructure (form and distribution of carbides, etc.). The literature regarding the stress corrosion cracking of high-strength steel is reviewed. Studies of slow crack growth in gaseous environments are reviewed, with a comparison of crack growth behavior in both gaseous and aqueous media. GRA

N75-32241# Ministry of Defence, London (England). Director of Research Materials 2 Air Systems.
CADMIUM COATINGS CONTAINING DISPERSED NICKEL PARTICLES FOR THE PROTECTION OF HIGH STRENGTH STEELS AGAINST CORROSION
G. Sanderson, L. M. Brazendale, and C. Larson Jul. 1974 21 p ref Prepared in cooperation with Fulmer Research Inst., Ltd., Stoke Poges, England
(AD-A002750; D-MAT-197; BR43515) Avail: NTIS CSCL 11/3

Slow strain rate and sustained load tensile tests on 300M and NCMV alloys have shown that the susceptibility of these high strength steels to hydrogen embrittlement during plating with cadmium, can be considerably reduced in both as-deposited and baked conditions by co-depositing nickel particles with the cadmium. The nickel particles are thought to preferentially absorb hydrogen both during plating and in the post-plate baking treatment. The corrosion resistance of Cd/Ni composite coated steel panels in outdoor exposure tests appears to be better than simple cadmium-plated steel panels under the same conditions. GRA

N75-32242# Union Carbide Corp., Parma, Ohio. Carbon Products Div.
TURBINE SHROUD ABRADABLE MATERIALS EVALUATION Final Draft Report
A. D. Butcher and J. D. Grigsby Feb. 1975 143 p
(Contract F33615-74-C-2026; AF Proj. 3066)
(AD-A010420; AFAPL-TR-75-12) Avail: NTIS CSCL 11/6

Transpiration-cooled gas turbine shroud structures were designed, built, and tested. The structures consisted of two layers of porous metal attached to an air distribution substrate. The permeability of the inner porous layer was controlled to limit and distribute the cooling air. The outer porous layer was made in a manner which permitted control of its abradability. The inner porous layer was made from a nickel-chromium alloy. Ceramic protected nickel-chromium, nickel-chromium-aluminum, and nickel-chromium-aluminum-titanium alloys were used in various samples for the outer porous layer. The samples were tested for oxidation resistance, rub tolerance, and cooling effectiveness at temperatures up to 1900F. The nickel-chromium-aluminum and nickel-chromium-aluminum-titanium alloys demonstrated properties desirable for this type of application. GRA

N75-32243# Naval Research Lab., Washington, D.C. Engineering Materials Div.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Semiannual Progress Report, 1 Aug. 1974 - 31 Jan. 1975
Lendell E. Steele, ed. Feb. 1975 46 p refs
(NRL Proj. M01-14)
(AD-A010510; NRL-MR-3010) Avail: NTIS CSCL 18/10

This report, covering research for the period, 1 August 1974 - 31 January 1975 includes: (1) the effect of hold time on fatigue crack propagation in neutron irradiated 20% cold worked Type 316 stainless steel; (2) high fluence assessments of 0.03% copper plate from 30-ton A533-B demonstration melt; (3) examination of microstructures of Inconel 718, Incoloy 800, PH13-8Mo, Mo and Nb after irradiation in EBR-II; (4) fluence dependence of ion damage in nickel; (5) ionsimulated irradiation-induced creep of reactor structural alloys; and (6) notch ductility and strength of Type 316 stainless steel submerged arc weld deposits. GRA

N75-32244# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
AN INVESTIGATION OF OBLIQUE PERFORATION OF METALLIC PLATES BY PROJECTILES Interim Scientific Report, 1974 - 1975
J. Awerbach and S. R. Bodner Mar. 1975 39 p refs
(Grant AF-AFOSR-2607-74; AF Proj. 9782)
(AD-A010508; MED-48; SR-6) Avail: NTIS CSCL 19/4

An experimental and analytical study was performed on the mechanics of oblique perforation of projectiles in metallic plates. The purpose was to determine the dependence of the velocity drop on the angle of impact for prescribed mechanical and physical properties of the projectile and the target plate. The ballistic experiments were carried out with 0.22 inch caliber lead bullets on target plates of commercially pure aluminum and an aluminum alloy which ranged from 2.0 to 6.0 mm in thickness. Transient measurements were taken which included high speed photographs of the perforation process. The theoretical model that had been developed previously by the authors for the case of normal perforation was modified to include the effects of the angle of impact. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N75-32245 Case Western Reserve Univ., Cleveland, Ohio.
POLYMER MORPHOLOGY: DEFORMATION, STRESS-CRACKING, AND PLASTICIZATION Ph.D. Thesis
Chloe Joi Singleton 1975 233 p
Avail: Univ. Microfilms Order No. 75-19246

The deformations due to high temperature drawing of polyoxymethylene (POM), room temperature rolling of POM and poly(4 methyl pentene-1) (P4MP1), and, in the case of POM, a combination of the two modes of deformation were studied. The techniques used were wide angle X-ray diffraction electron microscopy, and small angle X-ray scattering. A second area of research involved tensile deformation of 1/8 in. thick, notched strips of high, medium, and low density polyethylene (PE) in environmental stress-cracking agents. Deformation of the low density resins results in a highly fibrous type of failure in comparison with a more uniform type draw that occurs in an air environment. The failure surfaces were examined by scanning electron microscopy. Dissert. Abstr.

N75-32246 Princeton Univ., N.J.
CRYSTALLIZATION OF POLYMER MELTS DURING SHEAR FLOW Ph.D. Thesis
Robert Roy Lagasse 1974 259 p
Avail: Univ. Microfilms Order No. 75-20641

The kinetics of polymer crystallization during steady shear flow was studied experimentally along with the influence of the shear rate, the crystallization temperature, the polymer molecular weight, and the presence of heterogeneous additives. The onset of crystallization is detected by a rise in melt viscosity as the polymer melt is sheared isothermally in a parallel plate rheometer. Crystallization kinetics are characterized by an induction time, defined as the time elapsed from the start of shearing to the onset of crystallization. The measured induction time is shown to be independent of the polymer sample geometry in the parallel plate rheometer. Three different polymer materials are utilized in this investigation: linear polyethylene, isotactic polypropylene, and ethylene-propylene random copolymer. The crystallization behavior of each material is found to have the same general features. Analysis of the experimental results indicates that the elongation of molecular chain sections during the startup of shear flow may have no important influence on the crystallization of polymer melts during subsequent steady flow. Dissert. Abstr.

N75-32247*# College of William and Mary, Williamsburg, Va. Dept. of Chemistry.

MOLECULAR WEIGHT: PROPERTY RELATIONSHIPS OF HIGH PERFORMANCE POLYMERS USED FOR ADHESIVES AND COMPOSITES Final Report, 1 Sep. 1974 - 31 Aug. 1975

David Kranbuehl 31 Aug. 1975 21 p ref
(Grant NsG-1095)
(NASA-CR-143511) Avail: NTIS HC $3.25 CSCL 07C

Degradation of high performance polyimide precursor resins was investigated by measuring the molecular weight of the polymers in solution, using a membrane osmometer. It was found that polyimide precursor resins composed of BTDA and ODPA combined with DABP and MDA were unstable in DMAC. The degradation rate was found to depend upon the chemical nature of the isomeric diamine and the geometric structure about the amide linkage. The polymers of DABP were less susceptible to degradation than those of MDA and p,p'-compounds were more stable than m,m'-compounds. These results suggest that degradation is correlated with the basicity of the diamine. That is, the rate of the degradation reaction increases with the basicity of the diamine group in the polyimide precursor resin. The presence of water and a higher temperature increased the degradation rate of the polymers. Author

N75-32248# IIT Research Inst., Chicago, Ill.
ANALYTICAL-EXPERIMENTAL CORRELATION OF THE BIAXIAL STATE OF STRESS IN COMPOSITE LAMINATES (T-300/5208) Final Report, Jul. 1973 - Dec. 1974

Robert E. Rowlands Apr. 1975 140 p refs
(Contract F33615-73-C-3140; AF Proj. 1929)
(AD-A010423; AFFDL-TR-75-11) Avail: NTIS CSCL 11/4

The observed strength and stress-strain response of (0 sub 2/plus or minus 45) sub s T-300 fibers in 5208 epoxy laminates under varying biaxial stress ratios are compared with those predicted numerically. The four prediction techniques employed are those by Sandhu, Tsai-Wu, Petit-Waddoups and Hill. While all four theories were employed to predict laminate strength, numerical flow curves were generated only by the first three analyses. Actual experimental and numerically predicted results are compared for the following stress ratios; sigma sub x:sigma sub y: tau sub xy = 1:0:0; 3:1:1.732; 1:1:1; 5:1:2.236 and 0:1:0. Both flat and circular ring off-axis laminate specimens were employed by which to generate experimentally the biaxial data. In addition to the (02/+ or - 45))s laminate, variations in stacking sequence were considered for the off-axis ring specimens. Although the numerical predictions tended to over estimate the observed laminate strengths, the predicted stress-strain curves agree well with each other and with those observed experimentally. The off-axis ring specimens produced significantly higher strengths than did the corresponding flat coupons. Substantial variation in observed strength was observed with changes in stacking sequence. GRA

N75-32249# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CREEP OF POLYMER MATERIALS, THEORY AND APPLICATION

I. I. Bugakov 8 Jan. 1975 154 p refs Transl. into ENGLISH from the mono "Polzuchest Polimernykh Materialov, Teoriya i Prilozheniya" Moscow, 1973
(AD-A007177; FTD-MT-24-2892-74) Avail: NTIS CSCL 20/12

The molecular structure, creep properties, and mechanical properties of polymers are discussed along with amorphous and crystal polymer structures. M.J.S.

N75-32250# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROLE OF PLASTIC DEFORMATIONS AND POSSIBLE POLYMERIZATION OF ACRYLAMIDE UNDER SHOCK COMPRESSION

G. A. Adadurov, V. V. Gustov, M. Yu. Kosgin, and P. A. Yampolskii 5 Nov. 1974 12 p refs Transl. into ENGLISH from Gorenie i Vzryv (Moscow), 1972 p 529-532
(AD-A001173; FTD-HT-23-1983-74) Avail: NTIS CSCL 07/3

The object of this work is to further study the polymerization of monomers under shock compression, because if one is to explain the mechanisms, one must, in addition to the hydrodynamic aspects, consider the effects of nonunidimensional deformation of specimens under plane shock compression of preservation ampoules and possible thermal postpolymerization. GRA

N75-32251# Virginia Polytechnic Inst. and State Univ., Blacksburg. Div. of Minerals Engineering.
PREPARATION OF PURE AND IMPURITY-STABILIZED POLYMORPHS OF SILICA IN THE MINUS FIVE MICRON PARTICLE SIZE RANGE BY NON-COMMINUTION TECHNIQUES Final Report, 1 Jun. 1972 - 31 Aug. 1973

Jesse J. Brown, Jr. and Douglas F. Craig 1 Sep. 1973 81 p refs
(Grant F0122068)
(PB-241868/9; BM-OFR-34-75) Avail: NTIS HC $4.75 CSCL 08I

At present time the quantitative analysis of silica is of considerable importance to a number of governmental and industrial laboratories. The problem of analyzing silica in a composite dust sample is particularly difficult because of the large number of different forms that commonly exist in nature. An attempt was made to prepare in the pure state those silica phases that are ordinarily observed in minerals. Some 60 samples of assorted dusts were prepared. including quartz, cristobalite, tridymite, kaolinite, calcite, muscovite, illite, montmorillonite, Ba3(PO4)2, and YPO4. Several samples were prepared to include iron, manganese, and titanium impurities. These samples can be used to check analytical techniques being developed for field dust samples. GRA

N75-32252# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE COMPUTATION OF THE EFFECT OF PRECOOLING ON THE CARRYING CAPACITY OF HEAT-RESISTANT PLASTICS DURING SUBSEQUENT INTENSE ONE SIDED HEATING

Yu. M. Rodichev and E. A. Eskin 20 Jan. 1975 14 p refs Transl. into ENGLISH from Termoproch. Mater. Konstr. Elem., Sb. (USSR), no. 5, 1969 p 331-337
(AD-A006840; FTD-MT-24-0195-75) Avail: NTIS CSCL 11/9

An experiment was conducted on a typical heat-resistant reinforced plastic. Samples were tested of glass-fiber-reinforced plastics on bonding agent FN with filler in the form of fabric of a linen weave KT-11. The loading was determined by the fact that the strength of glass-fiber-reinforced plastics during bending is one the most sensitive characteristics to temperature change. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N75-32253*# Naval Ordnance Lab., White Oak, Md.
VAPOR PRESSURES AND HEATS OF SUBLIMATION OF SOME HIGH MELTING ORGANIC EXPLOSIVES Final Report

David F. Covell 1 Mar. 1975 40 p refs Sponsored in part by NASA
(NASA-CR-143508; AD-A008141; NOLTR-74-136) Avail: NTIS HC $3.75 CSCL 07/4

To determine the suitability of proposed organic explosives for space shuttle vehicle applications, heats of sublimation of the proposed explosives were determined as well as semi-quantitative data in regard to their physical and chemical stabilities. Heats of sublimation were derived from vapor pressure data which were obtained by the Langmuir method, wherein measurements are made of the rates of sublimation at constant temperature. Vapor pressure measurements were attempted for each of three explosives (viz., TPT, ONT, and PYX) at each of seven different temperatures in the range of 57C to 310C. Heat resistant qualities of these explosives were determined by (1) analyzing for chemical purity after heating to determine the presence of decomposition products, and (2) observing physical changes which took place as a result of the heating. GRA

N75-32254# Air Force Systems Command, Wright-Patterson AFB, Ohio.
PRINCIPLES OF PYROTECHNICS
A. A. Shidlovskii 23 Oct. 1974 537 p Transl. into ENGLISH of the book "Osnovy Pirotekhniki" Moscow, Izd vo Mashinostroyeniye, 1964 p 1-339
(AF Proj. 3059)
(AD-A001859; FTD-HC-23-1704-74) Avail: NTIS CSCL 19/1
The book presents the general theoretical principles of pyrotechnics and modern methods of preparation and calculation of pyrotechnic composition, and gives information on the properties of various types of pyrotechnic compositions. It provides a detailed description of the properties of the components, combustibles, and oxidizers; considerable attention is given to the physical nature of the combustion processes. The properties of various types of pyrotechnic compositions (illumination and ignition compositions, solid rocket fuel compositions, smoke screens) are discussed. GRA

N75-32255# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROCKET PROPELLANTS, CHAPTER 6
M. N. Aleshkov 19 Nov. 1974 27 p Transl. into ENGLISH from the book "Fizosnovy Raketnogo Oruzhiya" Moscow, Izd no Ministerstva Oborony-SSR, 1972 p 111-125
(FTD Proj. T74-04-05)
(AD-A001854; FTD-MT-24-2814-74) Avail: NTIS CSCL 21/9
This translation reviews solid, liquid and hybrid rocket propellants, their classification and reactions with fuels and oxidizers, their corrosivity, toxicity and storage stability. GRA

N75-32256# Naval Research Lab., Washington, D.C.
ORGANIC LININGS FOR CONCRETE STORAGE TANKS FOR PETROLEUM FUELS Interim Report, Jul. 1972 - Mar. 1975
Gerald E. Rohl May 1975 20 p refs
(NRL Proj. C03-28; YF545-9300)
(AD-A010514; NRL-MR-3039) Avail: NTIS CSCL 11/3
This report describes two new latex lining systems for concrete bulk fuel storage tanks and some tests upon proprietary concrete tank linings. Supplementary information regarding reinforcement fabrics for latex linings and the use of adhesion promoters is also included. GRA

N75-32257# Drexel Univ., Philadelphia, Pa.
STRESS WAVE PROPAGATION IN A PARTICULATE VISCOELASTIC COMPOSITE MATERIAL Final Contract Report
Albert S. D. Wang Apr. 1975 60 p refs
(Contract DAAD05-73-C-0251; DA Proj. 1W6-2113-A-660)
(AD-A010387; BRL-CR-224) Avail: NTIS CSCL 21/9
The present research investigates experimentally the various wave properties of a particulate composite, simulating a solid rocket propellant. The material used in the experiment is made of a soft polybutadiene as matrix and a filling material in the form of fine aluminum particles. The emphasis is placed upon the dispersion and scattering effects of the filling particles. Since the sizes of the particles range from 10 micrometers to 40 micrometers, the input wave lengths are required to be comparable to these dimensions. GRA

N75-32258# Air Force Academy, Colo. Frank J. Seiler Research Lab.
AN INVESTIGATION OF CHAPMAN-JOUGET DETONATION THEORY USING ISOTOPIC LABELLING
Raymond R. McGuire and Donald L. Ornellas Apr. 1975 17 p refs
(AF Proj. 7903)
(AD-A010001; SRL-TR-75-0004) Avail: NTIS CSCL 19/4
The explosive, bis-trinitroethyl adipate (BTNEA), was isotopically labelled in such a manner as to provide information on how an explosive breaks up during the detonation process. The material was fired in a detonation calorimeter giving product composition and heat release that are representative of the isentropic expansion of the detonation products. Isotope ratios observed in the detonation products were compared to those in the original explosive. The observed products are compared to those calculated with a thermodynamic-hydrodynamic computer code. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N75-32259 Florida Univ., Gainesville.
THE THERMODYNAMIC PRESSURE IN SUPERFLUID HELIUM AND ITS IMPLICATIONS FOR THE PHONON DISPERSION CURVE Ph.D. Thesis
Albert Robert Menard, III 1974 90 p
Avail: Univ. Microfilms Order No. 75-19364
The thermodynamic pressure of superfluid He-4, for seven densities from near saturated vapor pressure to 11 atm., was measured from 0.4 k to 1 k, using a capacitive strain gauge. A comparison of these measurements with calculations for the pressure, based on the phonon-roton model for superfluid helium, led to the conclusion that anomalous phonon dispersion exists in helium at low densities. The magnitude of the anomalous dispersion is in good agreement with that deduced from specific heat measurements. The conjecture of a quadratic term in the expression for the dispersion curve does not agree with these data. Contributions to the pressure not accounted for by phonons and rotons were observed. These contributions, probably maxons, increased in magnitude and became noticeable at a lower temperature as the density was increased. Dissert. Abstr.

N75-32260*# Boeing Aerospace Co., Seattle, Wash.
VACUUM JACKET FOR CRYOGENIC INSULATION, VOLUME 2 Final Contractor Report
D. L. Barclay, J. E. Bell, E. W. Brogren, and J. W. Straayer Apr. 1975 211 p
(Contract NAS3-15848)
(NASA-CR-134760; D180-18476-2) Avail: NTIS HC $7.25 CSCL 20L
The feasibility is demonstrated of producing a lightweight vacuum jacket using state-of-the-art technology and materials. Design and analytical studies were made on an orbital maneuvering system fuel tank. Preliminary design details were completed for the tank assembly which included an optimized vacuum jacket and multilayered insulation system. A half-scale LH2 test model was designed and fabricated and a force/stiffness proof test was conducted on the vacuum jacket. A vacuum leak rate of 0.00001 was measured, approximately 1500 hours of vacuum pressure was sustained, and 29 vacuum pressure cycles were experienced prior to failure. For vol. 1, see N75-26192. Author

N75-32261*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DEVELOPMENT OF THERMAL STRATIFICATION AND DESTRATIFICATION SCALING CONCEPTS. VOLUME 2: STRATIFICATION Final Report
T. N. Lovrich and S. H. Schwartz Oct. 1975 419 p 2 Vol.
(Contract NAS8-24747)
(NASA-CR-143945) Avail: NTIS HC $10.50 CSCL 20L
Temperature and pressure data obtained from the saturated Freon 113 PCA closed-tank stratification tests are presented. The data presented in tabular form are the test conditions, sensible heat values, and Freon 113 PCA liquid and ullage (vapor) properties. Also included, are graphical representations of the liquid bulk temperature and pressure histories, and dimensionless liquid-ullage delta-temperature profiles. Modified Grashof numbers and Fourier number-history data are also presented graphically. Author

N75-32262*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LOW GRAVITY PHASE SEPARATOR Patent Application
George F. Smoot (Calif. Univ., Berkeley), William L. Pope (Calif. Univ., Berkeley), and Lawrence Smith, inventors (to NASA) (Calif. Univ., Berkeley) Filed 12 Sep. 1975 18 p Sponsored by NASA
(NASA-Case-MSC-14773-1; US-Patent-Appl-SN-612966) Avail: NTIS HC $3.25 CSCL 20L

An apparatus for phase separating gas-liquid mixtures, particularly the gas and liquid phases of cryogens used for maintaining superconducting magnets, is described. The apparatus utilizes the property of helium diamagnetism, along with the strong magnetic fields existing around superconducting magnets, to prevent venting of the liquid phase of helium in a low gravity environment. The apparatus comprises a cryostat which includes an inner vessel for containing the cryogen, surrounding vapor-cooled shields and an outer vacuum shell. In addition, there is a structure for venting the cryogen (primarily the gaseous phase) from the cryostat and a superconducting magnetic coil mounted in the cryostat. The magnetic coil serves as a magnetic field source for orbiting experiments and repels the liquid phase of the cryogen from the vent outlet to reduce venting of the liquid phase of the cryogen. Diamagnetic cryogenic liquids other than helium may also be used. NASA

N75-32263# Factory Mutual Research Corp., Norwood, Mass.
INTEGRATION OF FIRE PROTECTION INTO LARGE AUTOMATED STORAGE SYSTEMS AT NAVAL SHORE FACILITIES, VOLUME 1 Final Report, Jun. 1973 - Aug. 1974
P. J. Chicarello Aug. 1974 53 p refs
(Contract N00025-73-C-0032)
(AD-A009520) Avail: NTIS CSCL 13/12

The history and development of rack storage fire protection is reviewed and the present state of the art is surveyed. The constraints imposed on fire protection by the construction and operational requirements of high rack storage systems are stated, and two methods of integrating fire protection into rack storage systems are described. Economic considerations are briefly discussed. GRA

N75-32264# Factory Mutual Research Corp., Norwood, Mass.
INTEGRATION OF FIRE PROTECTION INTO LARGE AUTOMATED STORAGE SYSTEMS AT NAVAL SHORE FACILITIES, VOLUME 2 Final Report, Jun. 1973 - Aug. 1974
P. J. Chicarello Aug. 1974 155 p
(Contract N00025-73-C-0032)
(AD-A009521) Avail: NTIS CSCL 13/12

Fire protection for storage facilities is discussed. Topics discussed include storage of expanded rubber, flammable liquid drum storage and dispensing, solid, palletized, and rack storage of plastics, and detailed summaries of rack storage fire tests. Author

N75-32265# Brush Wellman, Inc., Elmore, Ohio.
PRODUCTION ENGINEERING MEASURES TO MANUFACTURE SUPER FINE FINISH BERYLLIA Quarterly Progress Report, 1 Jan. - 31 Mar. 1975
Glenn H. Rees 25 Apr. 1975 28 p
(Contract DAAB07-74-C-0606)
(AD-A010403; BW-TR-565; QPR-3) Avail: NTIS CSCL 11/2

Surface finishes of four microinches and smoother have been developed on beryllia substrates 2 inch x 2 inch x .040 inch, 1 inch x 1 inch x .025 inch, and .080 inch x .110 inch x .010 inch. A tentative process has been established and used to prepare substrates for the Engineering Samples. Tests are underway to evaluate the Engineering Samples. GRA

N75-32266# Naval Postgraduate School, Monterey, Calif.
XR-3 CENTER OF GRAVITY CHARACTERISTICS M.S. Thesis
William M. Leins Mar. 1975 33 p refs
(AD-A009972) Avail: NTIS CSCL 13/10

Testing of the XR-3 Captured Air Bubble Testcraft was accomplished to determine the center of gravity location which results in the minimum thrust required for a given velocity. The optimum center of gravity was determined to be one hundred and nineteen inches forward of the stern transom for velocities higher than twelve knots. GRA

N75-32267# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF SEAL SHAPE VARIATIONS UPON THE PERFORMANCE OF THE XR-3 CAPTURED AIR BUBBLE TESTCRAFT M.S. Thesis
Robert William Moloney Mar. 1975 40 p refs
(AD-A009979) Avail: NTIS CSCL 13/10

A series of tests was conducted to determine the effects of seal shape upon the performance of the XR-3 captured air bubble testcraft. The report contains a brief description of the testcraft plus a more thorough description of the installed air spring seal and seal shape control mechanisms. A short description of the data gathering and reduction systems is also included. The report then presents data in graphical form showing the changes in the thrust (or drag) versus velocity characteristics as the shapes of the air spring seals are varied. Finally, the conclusions that may be drawn from the data are presented. GRA

N75-32268# National Bureau of Standards, Washington, D.C.
DIMENSIONS/NBS, VOLUME 59, NUMBER 5, MAY 1975 Monthly Technical News Bulletin
May 1975 25 p refs
(COM-75-50141-05; NBS/DIM-59/5; LC-25-26527) Avail: NTIS MF $2.25; SOD HC as C13.13:59/5 CSCL 05B

Major technical developments of the National Bureau of Standards (NBS) and highlights of work in progress are given along with major speeches and statements by Bureau management. Topics discussed include: guidelines for computerized electrons: air pollution standards; treaty of the Metre 1875-1975; the ozone problem; utility commissions and policy experiments; wear of dental filling material; surveillance camera guideline to help cut thefts; and NBS mercury standards to aid water pollution studies publications. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N75-32269 British Broadcasting Corp., Kingswood (England). Research Dept.
A VARIABLE-EMPHASIS LIMITER TO IMPROVE THE TECHNICAL QUALITY OF HF BROADCASTING
W. I. Manson Aug. 1975 5 p refs
(BBC-RD-1975/25) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The adaptation of a variable-emphasis limiter arrangement, devised originally for UHF and VHF/FM sound broadcasting, was investigated as a sound-signal processing system for HF broadcasting. Subjective tests were carried out to compare the speech intelligibility obtained in adverse conditions using an experimental variable-emphasis system with that obtained using the normal BBC processing technique. The results indicate a definite preference for the experimental system. Author

N75-32270 British Broadcasting Corp., Kingswood (England). Research Dept.
PROTOTYPE EQUIPMENT TO MEASURE CO-CHANNEL INTERFERENCE ON 625-LINE TELEVISION SIGNALS
M. J. Kallaway Aug. 1975 10 p refs
(BBC-RD-1975/24) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Prototype equipment designed to measure the level of Co-Channel Interference (CCI) on a 625-line television signal is described. The primary application of the CCI measuring equipment is at transmitters fed by re-broadcast links where it would measure the level of CCI on the incoming television signal and record it on a chart recorder. The CCI measuring equipment can distinguish between CCI sources with different frequency offsets between wanted and interfering carriers and so in many cases can identify the interfering sources. The fundamental and instrumental limits on the performance of the CCI measuring equipment is discussed in detail. It is concluded that this equipment should be able to measure levels of CCI close to the limits of perceptibility, subject to confirmation by extensive field trials. Author

N75-32271 Florida Univ., Gainesville.
REAL TIME COMPOSITE SIGNAL DECOMPOSITION Ph.D. Thesis

David Preston Skinner 1974 201 p
Avail: Univ. Microfilms Order No. 75-19391

The recovery was investigated in real-time of an unknown wavelet from a composite signal in the presence of additive noise; the composite signal consists of a wavelet and its echoes. Two techniques, the power and complex cepstra, were used in the wavelet recovery procedure. An alternate definition of the power cepstrum is presented which closely relates the two techniques, and makes computation of the power cepstrum from the complex cepstrum trivial. This unification led to the discovery of a third cepstrum technique, the phase cepstrum, which like the power cepstrum is useful in the determination of echo epoch times. Several problems inherent in cepstrum computation were examined. These problems include linear phase terms, phase unwrapping errors, aliasing, and oversampling. The effects of windowing (as used to reduce leakage in spectral analysis) at various stages in the wavelet recovery system are discussed. Algorithms suitable for use in a real-time wavelet recovery system were examined. Dissert. Abstr.

N75-32272 Missouri Univ., Columbia.
FM FAULT LOCATION ON SHORT POWER CABLES Ph.D. Thesis
Kittin Udomkiat 1974 159 p
Avail: Univ. Microfilms Order No. 75-20168

A method was developed for determining the fault distance on electrically short power cables using swept-frequency FM techniques. The method is based upon the observation that the envelope of the composite (transmitted plus reflected) signal at the sending end of the cable has the same pattern as the magnitude of the input impedance function of the cable over the range covered by the frequency sweep. When the cable is electrically short, only a fraction of a cycle of this impedance magnitude function is observed so that the coefficients of the first three Legendre polynomials suffice to fit the impedance curve. By comparing Legendre coefficients measured on a faulted cable with those computed in advance for a cable having identical parameters, the fault distance can be inferred. The algorithm was evaluated in terms of fidelity and sensitivity to parameter variations by means of both digital computer simulation and laboratory tests. A prototype hardware implementation of a Legendre coefficient measuring system which was designed and built during the study is described. Dissert. Abstr.

N75-32273 Ohio Univ., Athens.
A GENERAL THEORY OF BROADBAND MATCHING Ph.D. Thesis
Chandra Satyanarayana 1975 184 p
Avail: Univ. Microfilms Order No. 75-19286

In the design of communications systems, a basic problem is to transfer power efficiently from a given source system to a given load system over a desired band of frequencies. The problem was studied of designing an optimum, linear, time-invariant, lumped, passive, reciprocal, lossless equalizer to match an arbitrary passive or active but non-Foster, lumped load impedance to an arbitrary source system with lumped, passive non-Foster Thevenin equivalent impedance. The theory presented is a generalization of Bode-Fano-Youla broadband matching theory to include dissipative, frequency sensitive source impedance. The approach taken circumvents the need for replacing the load and source impedances by their Darlington equivalents and is applicable to passive as well as active loads. Dissert. Abstr.

N75-32274 California Univ., Los Angeles.
APPLICATIONS OF RATE DISTORTION THEORY TO THE BANDWIDTH COMPRESSION OF SPEECH SIGNALS Ph.D. Thesis
Donald Leslie Chaffee 1975 92 p
Avail: Univ. Microfilms Order No. 75-19680

A speech generation model utilized in the development of linear prediction coding (LPC) systems and some basic concepts of rate distortion theory are combined to develop the structure of a speech encoding system called rate distortion coding (RDC). Optimization criteria utilized in developing standard LPC systems (filter and pitch estimation) were used in the RDC structure. These criteria were used to specify the RDC algorithms necessary to source encode speech signals. Hueristic techniques based upon an RDC filter distortion measure were developed for the determination of the necessary filter banks in the new encoder. These techniques were used to generate filter banks for a small group of speakers; these filter banks were ordered according to a cost function analysis so that efficient simulation of a variety of channel data rates could be accomplished. A software simulation of an RDC and an LPC was developed for the purpose of experimentally comparing the two encoding systems. The simulation programs were used to process sample utterances from a variety of speakers in order to determine the quality of output speech over a range of channel data rates. Dissert. Abstr.

N75-32275 British Broadcasting Corp., Kingswood (England). Research Dept.
THE SUBJECTIVE EFFECTS OF INTERCHANNEL PHASE-SHIFTS ON THE STEREOPHONIC IMAGE LOCALISATION OF WIDEBAND AUDIO SIGNALS
J. S. Bower Sep. 1975 20 p refs
(BBC-RD-1975/27) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A series of subjective tests are described which are concerned with the effects of interchannel phase-shifts on stereophonic image localization. The tests, involving listeners experienced in subjective auditory judgements, were carried out in both a free-field room and a listening room. Quantitative information is given on the effects of phase-shifted signals on image position and spread. Subjective data are given on the acceptability of such signals in program material. The results are of relevance to the stereo compatibility of matrix quadraphonic systems which may prove useful in producing spatial effects for use in normal stereophony. Author

N75-32276 British Broadcasting Corp., Kingswood (England). Research Dept.
THE SUBJECTIVE EFFECTS OF INTERCHANNEL PHASE-SHIFTS ON THE STEREOPHONIC IMAGE LOCALISATION OF NARROWBAND AUDIO SIGNALS
J. S. Bower Sep. 1975 15 p refs
(BBC-RD-1975/28) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Frequency-dependent localization effects are quantified which occur when phase-shifts are present. This information is relevant when considering stereophonic signal processing which introduces phase-differences between the left and right signals. The narrowband results broadly confirm those relating to wideband signals and additionally show the importance of the inter-aural time and intensity difference. When the louder loudspeaker leads in phase, consistent trends are found as frequency is increased, but in the contrary situation where the weaker loudspeaker leads in phase, the ear appears to be confused and consistent changes with frequency are not found. Author

N75-32277 California Univ., San Diego.
THEORY OF SCINTILLATIONS DUE TO PROPAGATION THROUGH A TURBULENT MEDIUM Ph.D. Thesis
Marilyn Marians 1975 84 p
Avail: Univ. Microfilms Order No. 75-19635

Experiments dealing with diffraction of laser beams in the atmosphere and of radio waves in the solar wind generated an interest in developing a theory to describe the behavior of an electromagnetic wave as it travels through a turbulent medium. A specific objective in scintillation theory is to discover the relationship between the spectrum of intensity fluctuations measured by an observer and the spectrum of refractive index fluctuations in the medium. This relationship was worked out analytically for the case of weak scattering. However, for strong scattering, the problem is more difficult and must be solved numerically. Computations are made of spectra of intensity fluctuations resulting from the propagation of a plane wave through a thin but arbitrarily strong layer of refractive index variations. The computed spectra are found to duplicate the weak scattering approximation and the high frequency approximation where these approximations are expected to be valid. Dissert. Abstr.

N75-32278*# Raytheon Co., Wayland, Mass. Equipment Development Lab.
SIGNAL PROCESSING AND DISPLAY INTERFACE STUDIES Final Report, 21 May 1973 - 31 Jul. 1975

1 Sep. 1975 117 p
(Contract NAS8-29822)
(NASA-CR-143948; ER75-4349) Avail: NTIS HC $5.25 CSCL 17B

Signal processing equipment specifications, operating and test procedures, and systems design and engineering are described. Five subdivisions of the overall circuitry are treated: (1) the spectrum analyzer; (2) the spectrum integrator; (3) the velocity discriminator; (4) the display interface; and (5) the formatter. They function in series: (1) first in analog form to provide frequency resolution, (2) then in digital form to achieve signal to noise improvement (video integration) and frequency discrimination, and (3) finally in analog form again for the purpose of real-time display of the significant velocity data. The formatter collects binary data from various points in the processor and provides a serial output for bi-phase recording. Block diagrams are used to illustrate the system. Author

N75-32279# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MODEL AIRCRAFT L-BAND BEACON ANTENNA PATTERN GAIN MAPS
D. W. Mayweather 16 May 1975 156 p refs
(Contracts DOT-FA72WAI-261; F19628-73-C-0002)
(AD-A013187/7; ATC-44; FAA-RD-75-75) Avail: NTIS HC $6.25 CSCL 20/5

L-band antenna patterns for a variety of general aviation and air carrier aircraft are presented. These patterns were based on scale-model measurements. The antenna patterns are described by aircraft-coordinate-referenced elevation vs azimuth gain-contour maps. This method of presentation conveniently displays the effects of aircraft configuration on antenna patterns and allows one to observe the changes in a pattern that result from a change in wheel, flap, or antenna location. Author

N75-32280*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A THEORETICAL INVESTIGATION OF THE INPUT CHARACTERISTICS OF A RECTANGULAR CAVITY-BACKED SLOT ANTENNA
C. R. Cockrell Washington Sep. 1975 119 p refs
(NASA-TR-R-442; L-9990) Avail: NTIS HC $5.25 CSCL 17B

Equations which represent the magnetic and electric stored energies are derived for an infinite section of rectangular waveguide and a rectangular cavity. These representations which are referred to as being physically observable are obtained by considering the difference in the volume integrals appearing in the complex Poynting theorem. It is shown that the physically observable stored energies are determined by the field components that vanish in a reference plane outside the aperture. These physically observable representations are used to compute the input admittance of a rectangular cavity-backed slot antenna in which a single propagating wave is assumed to exist in the cavity. The slot is excited by a voltage source connected across its center; a sinusoidal distribution is assumed in the slot. Input-admittance calculations are compared with measured data. In addition, input-admittance curves as a function of electrical slot length are presented for several size cavities. For the rectangular cavity backed slot antenna, the quality factor and relative bandwidth were computed independently by using these energy relationships. It is shown that the asymptotic relationship which is usually assumed to exist between the quality bandwidth and the reciprocal of relative bandwidth is equally valid for the rectangular cavity backed slot antenna. Author

N75-32281*# National Aeronautics and Space Administration. Pasadena Office, Calif.
AN IMPROVED FURLABLE ANTENNA Patent Application
Morris A. Barnett, inventor (to NASA) (JPL) Filed 24 Sep. 1975 15 p
(Contract NAS7-100)
(NASA-Case-NPO-13553-1; US-Patent-Appl-SN-616333) Avail: NTIS HC $3.25 CSCL 09C

The antenna is characterized by an actuator comprising an elastomeric member of an annular configuration, and an annular array of uniformly spaced antenna ribs rigidly affixed at the base ends to the actuator and supported for pivotal displacement from a deployed configuration. The ribs are substantially radially extended from the actuator to a furled configuration, and are extended in substantial parallelism with the axis of the actuator. A reflector formed of a flexible mesh material is affixed to the ribs, and a plurality of angularly spaced bearing blocks support every radially extended section of the member for rotation about its own centroid. By employing an elastomeric annular member as a deployment actuator, it is possible to achieve deployment of relatively large dish-shaped antenna reflectors in a celestial space environment. NASA

N75-32282# Army Electronics Command, Fort Monmouth, N.J.
CAVITY METHOD FOR EXPERIMENTAL DETERMINATION OF THE SCATTERING MATRIX OF CONDUCTING BODIES: THEORY AND EXPERIMENTAL VERIFICATION Final Report, 1973 - 1974
J. Robert Christian Apr. 1975 32 p refs
(DA Proj. 1T1-61102-B-31A)
(AD-A009490; ECOM-4303) Avail: NTIS CSCL 20/14

The report summarizes the basic theory behind the cavity approach. First, theoretical aspects of formulating the scatter problem into matrix equations are reviewed. Then a simplified explanation regarding determination of the unknown matrix coefficients from sets of scatter field data is given. The basic theory involved in obtaining scatter field data by use of a cavity method is then outlined. And finally, some results of the experiments conducted to verify the approach are discussed, including an example of the determination of the admittance matrix of a spherical test scatterer. The possibility using a cavity method to determine radiation characteristics is also described. GRA

N75-32283# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
REFRACTIVITY GRADIENTS IN THE NORTHERN HEMISPHERE
C. A. Samson Apr. 1975 126 p refs
(AD-A009503; OTR-75-59) Avail: NTIS HC $5.75; HC also available from SOD CSCL 20/14

The continued expansion of microwave radio links and the resulting congestion have increased the need for better performance estimates. In the evaluation of refractivity effects, the designer may wish to consider the average gradients at specific locations for different seasons, as well as diurnal changes. This report presents graphs showing the cumulative probability distributions of the atmospheric radio refractivity gradients in the ground-based 100-m layer for 87 stations in the Northern Hemisphere. These are based on climatological data from radiosonde observations, and show the average conditions in one month of each season. A limited number of diurnal comparisons are included, as well as information on the climate of each site. GRA

N75-32284# Gautney and Jones Communications, Inc., Falls Church, Va.
PILOT INSTALLATION OF AUTOMATIC RADIOLOGICAL MONITORING SYSTEMS Final Report
Rowland S. Johnson Aug. 1974 237 p refs
(Contract OCD-PS-66-116)
(AD-A010264; G/J-TR-66.116-74.01) Avail: NTIS CSCL 09/6

The study describes adaptation of existing automatic air quality data acquisition and telemetry networks to include radiological monitoring. Two ranges of radiological equipment .1 R/hr - 10,000 R/hr (high range); and ambient background of up to 500 counts per minute (low range) were added on a single telemetry channel to air quality telemetry systems in New York City, Chicago, and the State of Delaware. Specialized interface equipment was designed and is described. A technique for digitally compressing five decades of radiological instrument dynamic range on a telemetry system capable of only three decades of range was developed. Data transmission links from the air monitoring network control station to Civil Defense emergency operating centers (EOC) were engineered and installed in New York City and Delaware. Use of a representative leased wire-line siren control system for combined siren control and radiological telemetry was investigated but not implemented because of tariff restrictions on the leased lines. Results indicated that use of air quality telemetry systems for radiological monitoring is technically and operationally feasible. GRA

N75-32285# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
RESEARCH STUDIES ON ELECTROMAGNETIC RADIATION AND ANTENNAS Final Report
Ronold W. P. King Jul. 1974 15 p refs
(Contract F19628-74-C-0060; AF Proj. 5635)
(AD-A010454; AFCRL-TR-74-0380) Avail: NTIS CSCL 09/5

Researchers under the Contract have been concerned with two topics: the cavity-backed slot antenna and the Beverage antenna. A complete quantitative understanding of the properties of the cavity-backed slot antenna was obtained in the form of extensive experimental data and an equivalent mathematical model. It is shown that the cavity-backed slot is not the complement of a strip dipole in the sense of Babinet's principle as has been assumed incorrectly in some instances. An omnidirectional array consisting of cavity-backed slots and dipoles was studied theoretically and experimentally and its omnidirectional properties were demonstrated. Work on the horizontal wire antenna parallel to and close to a plane earth progressed. Measurements to determine the wave number for the antenna in its dependence on the properties of the earth and its height were carried out and compared with a new theory of the horizontal wire antenna. Extension of this theory to the terminated horizontal wire antenna (Beverage antenna) was made. GRA

N75-32286# Center for Naval Analyses, Arlington, Va. Operations Evaluation Group.
CORRELATION OF DNC-14 FREQUENCY PREDICTIONS WITH OPERATIONAL EXPERIENCE
David B. Sanders Feb. 1975 39 p refs
(Contract N00014-68-A-0091)
(AD-A010142; CRC-278) Avail: NTIS CSCL 17/2

Data on frequencies actually used by Navy ships and communications stations is used to compare indicators of quality for those frequencies predicted by DNC-14 to propagate well with those predicted to propagate more poorly. The results indicate the extent to which attention paid to DNC-14 predictions can be expected to pay off in reduction of effort required to maintain circuit continuity. GRA

N75-32287# Lincoln Lab., Mass. Inst. of Tech., Lexington.
COHERENT OVERLAYING: A SIGNATURE ENHANCEMENT PROCESSING TECHNIQUE
Lee B. Spence 5 May 1975 32 p refs
(Contract F19628-73-C-0002; AF Proj. 2029)
(AD-A010477; TN-1975-31; ESD-TR-75-167) Avail: NTIS CSCL 17/9

A technique called coherent overlaying was developed for improving the signal-to-noise ratio in plots of radar return vs. time. The essential feature of the technique is a phase corrected summation of pulses which have been scattered by the same point on a target. Several test cases are discussed and the time signature of ATS-3 which was too weak to be extracted by regular processing of Millstone Hill radar data is presented. GRA

N75-32288# Air Force Weapons Lab., Kirtland AFB, N.Mex.
HIGH ALTITUDE CONDUCTIVITY MODELS FOR ELECTROMAGNETIC PULSE CALCULATIONS Final Report, Mar. 1973 - Feb. 1974
Leon A. Wittwer Apr. 1975 25 p refs
(AF Proj. 8809)
(AD-A010045; AFWL-TR-74-191) Avail: NTIS CSCL 20/14

A brief description is given of the conductivity models being currently used in high-altitude electromagnetic calculations along with comments on their applicability to specific scenarios. New fits are given for the physical parameters needed in calculating conductivity and other related atmospheric properties. GRA

N75-32289# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
APPLICATION OF LINEAR PROGRAMMING TECHNIQUES TO THE DESIGN OF RADAR ABSORBERS
B. S. Thornton Dec. 1974 170 p refs
(AF Proj. 7633)
(AD-A007052; AFAL-TR-74-181) Avail: NTIS CSCL 17/4

The report presents two new methods for solving problems in reducing electromagnetic back-scatter from conducting surfaces. The first method is concerned with optimizing the design of microwave absorbing multilayers for uniform response over wideband and wide angle of incidence subject to the constraint that a certain layer or layers to be included are specified for structural, thermodynamic, or other reasons. Up to two layers can be specified as to their sequence in the multilayer and their respective characteristic impedances within a given range. In the second part of the report a method is proposed for free-space impedance matching by using the control of effective surface impedance for a conducting surface by the geometry of indentations in the surface and the material filling them. The required frequency behavior of the dielectric and ferrite materials involved is deduced and the geometry and materials: characteristics of a simple case calculated to illustrate the method and orders of magnitude of the relevant parameters. GRA

N75-32290# Naval Postgraduate School, Monterey, Calif.
TECHNOLOGICAL FORECASTS FOR HARD COPY AND VIDEO DISPLAY COMMUNICATION TERMINALS M.S. Thesis
Herbert Charles Kaler Mar. 1975 89 p refs
(AD-A009984) Avail: NTIS CSCL 17/2

The study develops technological forecasts for hard copy and video display communications terminals. Changes in input/output parameters of the terminals, when the changes will occur, and how rapid the changes will be are estimated. These forecasts are determined by first measuring a limited number of performance parameters such as print rate and transmission speed. Then mathematical models are fitted to the performance parameter data and the trend extrapolated into the future to make predictions. GRA

N75-32291# Naval Research Lab., Washington, D.C.
PROPOSED NEAR FIELD SONAR TEST FACILITY NAVAL AIR REWORK FACILITY, NAVAL AIR STATION, NORTH ISLAND, SAN DIEGO Final Memorandum Report
W. James Trott and A. L. VanBuren Apr. 1975 38 p refs
(NRL Proj. S02-20)
(AD-A010511; NRL-MR-3016) Avail: NTIS CSCL 17/1

A sonar calibration facility is designed for helicopter dipped sonar test and evaluation. Special requirements were: minimize space requirement, minimize ambient noise for low signal hydrophone calibration, treat water to increase cavitation threshold for source calibration. The nearfield calibration array technique provides an accurate, efficient calibration facility that can economically meet these special requirements. GRA

N75-32292# Naval Research Lab., Washington, D.C.
EFFECT OF THE LOWER IONOSPHERE ON THE PROPAGATION OF WAVES FROM AN ELF/VLF SOURCE IN THE MAGNETOSPHERE
R. N. DeWitt, Francis J. Kelly, and Gerald A. Chayt 28 Apr. 1975 22 p refs
(NRL Proj. R07-30; RF21222401)
(AD-A010117; NRL-7868) Avail: NTIS CSCL 17/2

A modified form of the Smith-Pitteway full-wave program is used, in conjunction with various lower ionospheric profiles, to calculate the propagation characteristics of ELF/VLF waves from a source in the magnetosphere. Expressions are developed which give the ratio of the power transmitted into the earth's surface to the power incident on the ionosphere as a function of the number of wave hops in the earth-ionosphere waveguide. The wave polarization after each hop is obtained showing a limiting polarization after several hops. Numerical evaluation of these expressions are presented and discussed. GRA

N75-32293# Naval Underwater Systems Center, New London, Conn.
PHASING AND/OR CLIPPING TONES FOR A PEAK AMPLITUDE LIMITATION
Albert H. Nuttall 5 May 1975 55 p refs
(AD-A010519; NUSC-TR-4921) Avail: NTIS CSCL 09/4

Minimization of the peak value of the envelope (crest factor) of a narrowband waveform composed of N equal-amplitude equispaced sine waves, by means of phasing the individual tones, is investigated for a wide range of values of N. The method of solution is a numerical one, making judicious use of random search, gradient search, and the Fast Fourier Transform. Some

analytic results for a simple quadratic-phased technique are presented and augmented via numerical techniques to form a possible basis for synthesizing tone sets with acceptable peak envelope behavior for large N. The dependence of the minimum peak amplitude on modified quadratic phases, irregularly spaced tones, and clipping are also investigated. GRA

N75-32294# Naval Weapons Center, China Lake, Calif.
TARGET DETECTION WITH COLOR VERSUS BLACK AND WHITE TELEVISION Initial Report, Jul. - Nov. 1974
Dan W. Wagner Apr. 1975 39 p refs
(AD-A010126; NWC-TP-5731) Avail: NTIS CSCL 17/2

An experiment was conducted to investigate target detection performance on color and black and white TV. Green, brown, and gray model tank targets were viewed under 25, 35, and 300 TV lines resolution against a green and a brown background on a terrain model. Target-to-background luminance contrasts studied were positive (targets lighter than the surround), negative (targets darker than the surround), and zero. Gray targets were found to be more detectable than either brown or green targets. Higher resolution improved performance about equally for both color and black and white TV, and targets lighter than the background were detected more easily than either negative or zero contrast targets. GRA

N75-32295# Range Commanders Council, White Sands Missile Range, N.Mex. Communications Group.
TRANSMISSION OF IRIG TIMING Final Technical Report
Jul. 1968 53 p
(AD-A010281) Avail: NTIS CSCL 14/2

The paper presents the basic criteria and techniques applied in deriving the suggested Criteria for IRIG B Timing Transmission. The study is based on the common usage of a 1 kHz carrier, amplitude modulated at a ratio of 3:1. It is hoped to provide some insight into the basic problems encountered in delivering reliable IRIG timing. GRA

N75-32296# Range Commanders Council, White Sands Missile Range, N.Mex. Communications Working Group.
IRIG TRACKING RADAR COMPATIBILITY AND DESIGN STANDARDS FOR G-BAND (4 TO 6 GHz) RADARS (FORMERLY C-BAND 5 CM) Final Report
Apr. 1974 16 p refs
(AD-A010280; IRIG-105-74) Avail: NTIS CSCL 16/1

The document is presented in two major sections. Section I outlines the minimum noncoherent G-Band (4-6 GHz) radar compatibility standards for inter-range use. Emphasis is placed primarily on the transmitter and receiver characteristics since these are the major radar subsystems which must be standardized to insure compatibility. Section II provides quidelines for the design of new G-band noncoherent instrumentation radars. GRA

N75-32297# Range Commanders Council, White Sands Missile Range, N.Mex. Electronic Trajectory Measurements Working Group.
A SURVEY OF RADAR CALIBRATION METHODS: C-BAND METRIC INSTRUMENTS Final Report
Nov. 1971 21 p refs
(AD-A010277) Avail: NTIS CSCL 17/9

The document was published to promote more uniform calibration practices at the ranges and increase the probability that the potential accuracy of instrumentation radars can be achieved when needed; to assess the adequacy current techniques (for radar calibration) which eliminate or provide for the correction of data errors in the range, range-rate, and angle channels of C-band instrumentation radars, such as the AN/FPS-16, AN/MPS-36, and MIPIR (Missile Precision Instrumentation Radars) series. GRA

N75-32298# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Electrical and Computer Engineering.
DISTRIBUTION-FREE TECHNIQUES OF SIGNAL DETECTION FOR NOISY CHANNEL WITH RANDOM FADING AND INTERSYMBOL INTERFERENCE Final Report, 1 Apr. 1971 - 31 Dec. 1974
Mohammad Arozullah 27 May 1975 16 p refs
(Contract N00014-70-A-0311-0002; NR Proj. 042-274)
(AD-A010207; TR-75-1) Avail: NTIS CSCL 09/4

The research reported here was concerned with the design of distribution-free detectors for M-ary constant or time varying signals perturbed by random fading of unknown distribution, intersymbol interference due to linear time invariant filtering and an additive noise of unknown distribution. GRA

N75-32299# IIT Research Inst., Chicago, Ill.
STUDY OF MULTIPLE ACCESS-DISCRETE ADDRESS NAVY TACTICAL VOICE COMMUNICATIONS. VOLUME 1: EXECUTIVE SUMMARY Final Report, 7 Jan. 1974 - 6 Jun. 1975
B. I. Marks, R. V. Janc, and N. P. Murarka 6 Jun. 1975 12 p
(Contract N00014-74-C-0239; NR Proj. 274-194)
(AD-A010538) Avail: NTIS CSCL 17/2

The purpose of this study is to determine the feasibility of incorporating Multiple Access-Discrete Address (MADA) capability into Naval tactical voice radio communications. MADA is an automatic channel switching communication system which allows the limited radio channels available to a platform to be shared by subscribers of different tactical nets. This contrasts with the current dedicated channel system where each subscriber, hence net, are assigned one channel solely for their traffic. The MADA system studied is evolutionary in that it is compatible with the current command structure, radio equipments, and dedicated channel system. A communications scenario is developed, the operational features of a MADA system are specified, the theoretical performance of MADA and the dedicated channel system are compared, and the cost of an initial intra-task group surface-to-surface, line-of-sight MADA implementation is estimated. GRA

N75-32300# General Electric Co., Santa Barbara, Calif.
AIDS FOR THE STUDY OF ELECTROMAGNETIC BLACKOUT
Warren S. Knapp and Kenneth Schwartz 25 Feb. 1975 202 p Revised
(Contract DNA001-72-C-0180)
(AD-A010228; GE74TMP-33-Rev; DNA-3499H-Rev) Avail: NTIS CSCL 18/3

The report is a compendium of selected graphs, charts, equations, and relations useful in the analysis of electromagnetic blackout caused by nuclear explosions. Information is provided on weapon outputs, ionization source functions, deionization, absorption, phase effects, and noise. The report also contains sections listing atmospheric properties, physical constants, definition of symbols, and a glossary of frequently used terms. GRA

N75-32301# Culler/Harrison, Inc., Goleta, Calif.
REAL TIME IMPLEMENTATION OF AN LPC ALGORITHM. SPEECH SIGNAL PROCESSING RESEARCH AT CHI
Glen J. Culler, Michael McCammon, and James F. McGill May 1975 97 p refs
(Contract DAHC15-73-C-0252; ARPA Order 2359)
(AD-A010532; CHI-QTR-101) Avail: NTIS CSCL 17/2

During the contract period reported here, the authors implemented a real time Linear Predictive coding algorithm for speech data compression developed by Markel and Gray at SCRL Chapter 1 of this report documents this implementation and reports on its use over the ARPANET. Data collection equipment for a physical acoustics laboratory was designed and prototyped. Both the prototype and the multiplexed data collection system are documented in Chapter 2 of this report. GRA

N75-32302# Naval Electronics Lab. Center, San Diego, Calif.
PROPAGATION MODELING IN THE EVAPORATION DUCT
H. V. Hitney 1 Apr. 1975 39 p refs
(SF12141014)
(AD-A010534; NELC/TR-1947) Avail: NTIS CSCL 20/14

A waveguide propagation model is described and applied to a wide variety of evaporation ducting conditions. Particular emphasis is placed on the relative advantages of various antenna heights. GRA

N75-32303# Cincinnati Electronics Corp., Ohio.
RADIO SET AN/PRC-70 Quarterly Report, 1 Jan. - 31 Dec. 1974

C. A. Bucher Feb. 1975 34 p refs
(Contract DAAB07-71-C-0319; DA Proj. 1S6-674701-D-535) (AD-A010399; Rept-80045-PRC40/175; ECOM-0319-8-71; QR-8) Avail: NTIS CSCL 17/2

The effort during the period was directed primarily toward the solution of EMI and coupler tuning problems, as well as receipt of vendor material. Construction and test of modules and subassemblies for the ET/ST radios were significant activities during the period. Acceptance testing was started with expected test completion in February 1975. GRA

N75-32529 Joint Publications Research Service, Arlington, Va.
PHENOMENON OF COHERENT REFLECTION OF PULSED RADIO SIGNALS FROM A WAVY SEA SURFACE
I. V. Kireyev and A. V. Svechnikov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 128-133 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 97-100 (For availability see N75-32517 23-42)

N75-32558 Southampton Univ. (England). Dept. of Physics.
DETERMINATION BY TRIANGULATION OF THE REGIONS WHERE WHISTLERS EMERGE FROM THE IONOSPHERE
M. J. Rycroft, M. J. Jarvis, and H. J. Strangeways *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 225-232 refs (For availability see N75-32532 23-42)

N75-32559 Oslo Univ. (Norway). Inst. of Cosmic Physics.
ROCKET OBSERVATIONS OF SMALL-SCALE IRREGULARITIES IN THE AURORAL F-REGION
T. E. Moe, A. Egeland, J. A. Holtet, D. S. Evans (NOAA, Boulder, Colo.), and W. Ecklund (NOAA, Boulder, Colo.) *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 233-237 refs (For availability see N75-32532 23-42)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N75-32304 Arizona Univ., Tucson.
DESIGN OF ELECTROTHERMAL PULSE GENERATORS Ph.D. Thesis
Joseph Byron McCormick 1975 223 p
Avail: Univ. Microfilms Order No. 75-19605

An electrothermal circuit (ETC) is a circuit which utilizes the interaction between electrical and thermal variables in an insulated integrated circuit to achieve low frequency transfer functions and large time constants without the use of large external capacitors. The ETC technique was applied to the design of pulse generators, and ETC morphologies, fabrication techniques, and circuitry are presented. Limitations of simple ETC pulse generators are analyzed, and it is shown that the pulse duration of a single-chip circuit is dependent upon the ambient temperature. A two-chip circuit is designed in which the pulse duration is insensitive to ambient temperature, and experimental results are given. More sophisticated circuits were developed, and experimental results are given for a configuration which extends the range of pulse durations to the order of several minutes, and for a configuration which permits duty cycles up to 100% with little change of pulse duration. The ETC concepts used in the development of pulse generators were extended to the design of a voltage-controlled oscillator (VCO); an ETC phase-locked loop using the VCO is also described. Dissert. Abstr.

N75-32305 Michigan Univ., Ann Arbor.
NONLINEAR EFFECTS IN ELECTRICAL TUNING OF NEGATIVE RESISTANCE OSCILLATORS Ph.D. Thesis
Young El Ma 1975 248 p
Avail: Univ. Microfilms Order No. 75-20399

The electrical tuning characteristics of negative-resistance oscillators were studied using a reverse-biased varactor diode as a tuning element. Information is provided on tuning circuit phenomena which arise from the varactor diode nonlinear junction capacitance such as nonlinear resonance and frequency multiplication. A simplified circuit was used for part of the analysis, to expose the basic principles; the analysis can be extended readily to include the parasitic elements associated with diode packaging and mounting. Dissert. Abstr.

N75-32306 Michigan Univ., Ann Arbor.
PROPERTIES OF S-BAND TRAPATT DIODE OSCILLATORS Ph.D. Thesis
Robert James Trew 1975 260 p
Avail: Univ. Microfilms Order No. 75-20465

A simplified computer model of a TRAPATT oscillator that considers the operation of the device from the terminal voltage-current waveforms was developed. This model allows the investigation of arbitrary current waveforms and can be used in the study of harmonic tuning effects and the requirements for high-efficiency operation. It was determined that the oscillator efficiency is primarily dependent upon the amplitude and phase angle of the fundamental signal and the phase angle of the second-harmonic component. An extensive experimental investigation of an S-band TRAPATT oscillator is described, and the operational characteristics of the oscillator are presented. The diode-microwave circuit interaction was investigated with the aid of network analyzer impedance measurements of the oscillator circuit under varying efficiency and frequency conditions. Optimization of the TRAPATT oscillator is considered from both the solid-state device and microwave circuit points of view. Dissert. Abstr.

N75-32307 Wisconsin Univ., Madison.
A STUDY OF CURRENT CROWDING IN BIPOLAR TRANSISTORS Ph.D. Thesis
Darius Framroze Tanksalvala 1975 137 p
Avail: Univ. Microfilms Order No. 75-12927

The existing theory which considers an equipotential emitter was extended to include the effects of the distributed emitter resistances along and perpendicular to the emitter base junction. It was found that the resistance along the junction causes the emitter current to crowd towards both, the emitter and base contacts, unlike the existing theory where it crowds only towards the base contact. The resistance normal to the junction, which simulates a distributed ballust resistance was found to reduce crowding. The reduction in crowding was more pronounced at high currents. The effects of voltage dependent collector multiplication and distributed collector resistance were studied. Transient current crowding was studied and found to be considerably different from dc crowding. Thermal effects on current crowding are discussed, in order to determine the susceptibility of a transistor to second breakdown, and the stabilizing effects of distributed emitter and collector resistances. Dissert. Abstr.

N75-32308 Southern Methodist Univ., Dallas, Tex.
SYNTHESIS OF CONDUCTIVE NETWORKS ON MULTIPLE TREE PORT STRUCTURES Ph.D. Thesis
James Daniel Powers 1975 109 p
Avail: Univ. Microfilms Order No. 75-18870

The following results of the study are discussed: (1) a procedure using topological properties of the SCCM sign pattern to determine the multiple-tree port structures with which it is compatible; (2) the justification and applicability of unimodular congruent transformations to carry the SCCM and its accompanying subtrees to the desired starlike configuration; (3) a set of simultaneous nonlinear inequalities comprising a set of conditions both necessary and sufficient for realization of an n-port network of prescribed configuration on (n + 2) nodes; (4) a set of weak sufficient conditions for (n + 2)-node realization simple enough to be of potential value in reducing computational work; (5) a set of weak necessary conditions simple enough to be of potential value in eliminating some matrices from further consideration; and (6) a formulation of a subset of the necessary and sufficient conditions into format for solution as a linear programming problem in order to provide trial solutions for examination with the complete set. Dissert. Abstr.

N75-32309 Carnegie-Mellon Univ., Pittsburgh, Pa.
MAGNETIC BUBBLE PROPAGATION USING DISTRIBUTED ELECTRIC CURRENTS Ph.D. Thesis
Timothy John Walsh 1975 156 p
Avail: Univ. Microfilms Order No. 75-17850

The interaction between a magnetic bubble domain and a distributed current flowing in a neighboring nonuniform conducting sheet is proposed as the basis of a bubble drive. This technique eliminates the in-plane field and drive coils required by field-access circuits while avoiding the multiple connections required by conventional current-access schemes. Bubble propagation was achieved by exciting the overlay with an oscillating or rotating electric field. The resulting nonuniform current exerts forces on the bubble which are computed using the current-field interaction. A theoretical analysis is presented in which the forces, bubble potential energy, and the normal component of magnetic field averaged through the platelet thickness are expressed as double trigonometric series. The results are valid for conducting sheets of infinite extent whose conductivities vary periodically in the sheet plane. The operation of two specific overlay configurations was simulated on a computer. Dissert. Abstr.

N75-32310 New Mexico Univ., Albuquerque.
FUNCTIONAL METHOD FOR MULTIPLE DETECTION AND LOCATION IN COMBINATIONAL CIRCUITS Ph.D. Thesis
Ka-Mgow Wong 1974 71 p
Avail: Univ. Microfilms Order No. 75-18643

By subcircuit duplication and use of DeMorgan's Laws, any combinational circuit can be transformed into the alternate AND-OR or OR-AND circuit called equivalent normal form. The equivalent normal form has fan-out points only at the primary inputs and inverters only at the primary inputs or at the fan-out branches. A circuit realizes a Boolean function; a fault or faults forces the circuit to realize an additional function called a fault function. It is shown that the equivalent normal form of a tree circuit has the same set of fault functions as the original circuit; the total number of fault functions is shown to be 2(n) for the circuit with n primary inputs. It is shown that the set of all fault functions in the equivalent normal form of a nontree circuit includes all fault functions of the original circuit. The equivalent normal form can be employed when the complete test set is to be obtained. An extensive analysis of the effect of redundancy on multiple fault detection is given. Dissert. Abstr.

N75-32311 Fordham Univ., New York.
THE ALTERNATING CURRENT MUTUAL INDUCTANCE TECHNIQUE Ph.D. Thesis
Frank Joseph Sena, Jr. 1975 91 p
Avail: Univ. Microfilms Order No. 75-18897

A study was undertaken to demonstrate the applicability of the ac technique to weakly paramagnetic and diamagnetic materials in the temperature range of 78 K to 300 K. To achieve the needed sensitivity and to overcome problems associated with the ac technique, the following parameters affecting sensitivity and overall performance were investigated: mutual inductance coils, reproducibility and temperature control, correlation of mutual inductance and magnetic susceptibility, and the effect of varying the ac frequency. Optimization of the above parameters produced a 20 fold increase in sensitivity over previous systems. Dissert. Abstr.

N75-32312# Aerojet Electrosystems Co., Azusa, Calif.
THIN-FILM-TRANSISTOR STABILITY INVESTIGATION Final Report, 1 Apr. - 31 Dec. 1974
Gordon Kramer 31 Jan. 1975 50 p refs
(Contract N00014-74-C-0265; NR Proj. 215-235; NR Proj. 121-411)
(AD-A006934; AESC-5014) Avail: NTIS CSCL 09/1

This program was undertaken to identify the key parameters required for stable operation of thin-film transistors (TFTs), to define the range of stable operation, and to assess TFT-device reliability and yield. Lead sulfide (PbS) and lead selenide semiconductors were found to produce stable TFFs (i.e., free from ionic-drift and carrier-trapping effects) in combination with aluminum oxide (Al2O3) as the gate dielectric, but lead telluride devices exhibited carrier trapping. Stable TFT operation was obtained with chromium, molybdenum, or tungsten source/drain electrodes, while aluminum, titanium, lead, and gold electrodes were not as satisfactory. Unsatisfactory devices were obtained with silicon dioxide as the gate insulator. Stable PbS TFT operation was demonstrated over the range from -196 to -125C. GRA

N75-32313 New Mexico Univ., Albuquerque.
STABILITY AND SYNTHESIS OF TWO DIMENSIONAL DIGITAL RECURSIVE FILTERS Ph.D. Thesis
Winser Edward Alexander 1974 195 p
Avail: Univ. Microfilms Order No. 75-18644

An approach to stability analysis of two dimensional digital recursive filters is presented. A matrix recursive equation corresponding to the recursive algorithm for the two dimensional digital recursive filter is defined. This equation is used to formulate necessary conditions for stability of the two dimensional digital recursive filter in terms of the magnitudes of the eigenvalues of the matrices in the matrix recursive equation. These conditions for the general case are shown to be necessary and sufficient conditions for stability when the spatial frequency response characteristic for the filter in question has a particular symmetry. A procedure for the synthesis of filters with approximately circularly symmetric squared magnitude characteristics is also presented. Examples of image processing applications using filters designed with this procedure are given. Dissert. Abstr.

N75-32314 Michigan Univ., Ann Arbor.
NOISE PROPERTIES OF IMPATT DEVICES Ph.D. Thesis
Chente Chao 1975 328 p
Avail: Univ. Microfilms Order No. 75-20312

A study was conducted: to investigate the noise properties of IMPATT diodes as a function of device structure, material parameters and operating conditions; to determine the optimum noise performance which is achievable for IMPATT diodes when they are used as oscillators and amplifiers; to obtain an improved physical understanding of noise and its relationship to other important nonlinear properties such as the dc-to-RF conversion efficiency and RF power generation of IMPATT devices; and to derive important design and operating criteria regarding noise, efficiency, and power for oscillator and amplifier applications using IMPATT diodes. To achieve these goals, a comprehensive study of the noise properties of IMPATT diodes was carried out. Dissert. Abstr.

N75-32315 Florida Univ., Gainesville.
ELECTRODE EFFECTS IN AMORPHOUS SEMICONDUCTORS Ph.D. Thesis
Rustom Faramroze Irani 1974 187 p
Avail: Univ. Microfilms Order No. 75-19347

The electrical properties of certain binary and ternary amorphous semiconductors are presented. Frequency dependent conductance, noise, voltage-current relationships and switching in these materials were investigated. The electrode effects on frequency variation of conductance were determined by making admittance measurements while applying a dc bias to the device. A small signal ac model based on the formation of space charge regions at the two metal-semiconductor interfaces was proposed. The frequency behavior of the model is found to be a good approximation to the frequency behavior of Ge4Te15As aluminum sandwich and aluminum planar devices. Noise data for the Ge4Te15As aluminum sandwich, aluminum planar and molybdenum planar devices were taken under dc bias and zero bias conditions. The nonohmic voltage-current relationship observed for the aluminum sandwich and aluminum planar devices was explained in terms of Schottky barrier formations at the two metal-semiconductor interfaces. Filamentary structural changes were observed under pulsed conditions using the scanning electron microscope. Dissert. Abstr.

N75-32316*# Auburn Univ., Ala. Electronics Research Lab.
MODULATION LINEARIZATION OF A FREQUENCY-MODULATED VOLTAGE CONTROLLED OSCILLATOR, PART 3 Final Report
M. A. Honnell Sep. 1975 63 p refs
(Contract NAS8-26193)
(NASA-CR-143950) Avail: NTIS HC $4.25 CSCL 09C

An analysis is presented for the voltage versus frequency characteristics of a varactor modulated VHF voltage controlled oscillator in which the frequency deviation is linearized by using the nonlinear characteristics of a field effect transistor as a signal

amplifier. The equations developed are used to calculate the oscillator output frequency in terms of pertinent circuit parameters. It is shown that the nonlinearity exponent of the FET has a pronounced influence on frequency deviation linearity, whereas the junction exponent of the varactor controls total frequency deviation for a given input signal. A design example for a 250 MHz frequency modulated oscillator is presented. Author

N75-32317*# Auburn Univ., Ala. Dept. of Electrical Engineering.
DEVELOPMENT OF AUTOMATED TEST PROCEDURES AND TECHNIQUES FOR LSI CIRCUITS Final Technical Report
B. D. Carroll 4 Sep. 1975 101 p refs
(Contract NAS8-31190)
(NASA-CR-143951) Avail: NTIS HC $5.25 CSCL 09C

Testing of large scale integrated (LSI) logic circuits was considered from the point of view of automatic test pattern generation. A system for automatic test pattern generation is described. A test generation algorithm is presented that can be applied to both combinational and sequential logic circuits. Also included is a programmed implementation of the algorithm and sample results from the program. Author

N75-32318*# Radio Corp. of America, Camden, N.J. Automated Systems Div.
ONE WAY DOPPLER EXTRACTOR. VOLUME 2: DIGITAL VCO TECHNIQUE Final Report, 1 Jul. 1973 - 1 Nov. 1974
E. J. Nossen and E. R. Starner Dec. 1974 108 p refs
(Contract NAS9-13517)
(NASA-CR-141574; Rept-13517-F-2-Vol-2) Avail: NTIS HC $5.25 CSCL 09C

A feasibility analysis and trade-offs for a one-way Doppler extractor using digital VCO techniques is presented. The method of Doppler measurement involves the use of a digital phase lock loop; once this loop is locked to the incoming signal, the precise frequency and hence the Doppler component can be determined directly from the contents of the digital control register. The only serious error source is due to internally generated noise. Techniques are presented for minimizing this error source and achieving an accuracy of 0.01 Hz in a one second averaging period. A number of digitally controlled oscillators were analyzed from a performance and complexity point of view. The most promising technique uses an arithmetic synthesizer as a digital waveform generator. Author

N75-32319*# Rockwell International Corp., Downey, Calif. Space Div.
A SURVEY OF ATL-COMPATIBLE RADIOMETER ANTENNAS Final Report
A. W. Love Aug. 1975 50 p refs
(Contract NAS1-10691)
(NASA-CR-132745; SD75-SA-0125) Avail: NTIS HC $3.75 CSCL 09C

A survey was made of antennas suitable for remote sensing of the earth's surface, in particular the world ocean, by means of microwave radiometers operating in the 1 to 26 GHz frequency region and carried on board the shuttle-launched advanced technology laboratory. Array antennas are found to be unattractive and unsuited to the task. Reflectors, including Cassegrain and offset types, as well as horn-reflectors are possible candidates but all have shortcomings which impair the accuracy of measurement. Horns of the corrugated type have excellent electrical characteristics. Although they are physically very large and will require development of suitable deployment mechanisms, they appear to be valid candidates for the task. The evolution of the periscope antenna is outlined, and it is shown to possess nearly ideal electrical characteristics for the intended application. Its only shortcoming is that the feed horn creates aperture blocking; there is no blocking due to struts or any other source. The periscope antenna is recommended for ATL radiometry. Author

N75-32320*# National Aeronautics and Space Administration, Washington, D.C.
ELECTRONIC COMPONENTS SUBSYSTEMS AND EQUIPMENT: A COMPILATION Technology Utilization
May 1975 38 p
(NASA-SP-5971(03)) Avail: NTIS HC $3.75 CSCL 09A

Developments in electronic components, subsystems, and equipment are summarized. Topics discussed include integrated circuit components and techniques, circuit components and techniques, and cables and connectors. Author

N75-32321*# Transemantics, Inc., Washington, D.C.
A METHOD FOR DETERMINING ELECTROCHEMICO-KINETIC PARAMETERS RELATING TO THE ROTATING DISK ELECTRODE
Jan Malyszko Washington NASA Sep. 1975 7 p Transl. into ENGLISH from Chimia (AARAU), v. 29, no. 4, Apr. 1975 p 166-168
(Contract NASw-2792)
(NASA-TT-F-16556) Avail: NTIS HC $3.25 CSCL 09C

A simple question was proposed for calculating the first order rate constant of electrode reactions proceeding at the rotating disc. The expression discussed was applied to determine the kinetic parameters of the system Cu(II)/Cu(I) in 2M LiCl at a Pt electrode. Author

N75-32322*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE RELATIONSHIP BETWEEN RELIABILITY AND BONDING TECHNIQUES IN HYBRID MICROCIRCUITS
S. V. Caruso, D. L. Kinser (Vanderbilt Univ.), S. M. Graff (Vanderbilt Univ.), and R. V. Allen (ATI, Sunnyvale, Calif.) Sep. 1975 28 p refs
(NASA-TM-X-64954) Avail: NTIS HC $3.75 CSCL 09C

Differential thermal expansion was shown to be responsible for many observed failures in ceramic chip capacitors mounted on alumina substrates. It is shown that the mounting techniques used in bonding the capacitors have a marked effect upon the thermally induced mechanical stress and thus the failure rate. A mathematical analysis was conducted of a composite model of the capacitor-substrate system to predict the magnitude of thermally induced stresses. It was experimentally observed that the stresses in more compliant bonding systems such as soft lead tin and indium solders are significantly lower than those in hard solder and epoxy systems. The marked dependence upon heating and cooling rate was proven to be a determining factor in the prediction of failure solder systems. It was found that the harder or higher melting solders are less susceptible to thermal cycling effects but that they are more likely to fail during initial processing operations. Strain gage techniques were used to determine thermally induced expansion stresses of the capacitors and the alumina substrates. The compliance of the different bonding mediums was determined. From the data obtained, several recommendations are made concerning the optimum bonding system for the achievement of maximum reliability. Author

N75-32323*# National Aeronautics and Space Administration. Pasadena Office, Calif.
DISTRIBUTED FEEDBACK ACOUSTIC SURFACE WAVE OSCILLATOR Patent Application
Charles Elachi, inventor (to NASA) (JPL) Filed 12 Sep. 1975 17 p
(Contract NAS7-100)
(NASA-Case-NPO-13673-1; US-Patent-Appl-SN-613004) Avail: NTIS HC $3.25 CSCL 09C

An acoustic surface wave oscillator is constructed from a semiconductor-piezoelectric acoustic surface wave amplifier by providing appropriate perturbations at the piezoelectric boundary. The perturbations cause Bragg order reflections that maintain acoustic wave oscillation under certain conditions of gain and feedback. NASA

N75-32324*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Consumables Analysis Section.
ELECTRICAL-POWER-SYSTEM DATA BASE FOR CONSUMABLES ANALYSIS. VOLUME 1: ELECTRICAL EQUIPMENT LIST, ACTIVITY BLOCKS, AND TIME LINES
Marvin D. Pipher, P. A. Green, and D. F. Wolfgram 1 May 1975 285 p refs
(Contract NAS9-13970)
(NASA-CR-144459; JSC-09448-Vol-1; JSC-IN-75-FM-14-Vol-1) Avail: NTIS HC $8.75 CSCL 09C

A standardized data base is described which consists of a space shuttle electrical equipment list, activity blocks defining

electrical equipment utilization, and activity-block time lines for specific mission analyses. Information is presented to facilitate utilization of the data base, to provide the basis for the electrical equipment utilization to enable interpretation of analyses based on the data contained herein. Author

N75-32325*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Consumables Analysis Section.
ELECTRICAL-POWER-SYSTEM DATA BASE FOR CONSUMABLES ANALYSIS. VOLUME 2: ELECTRICAL EQUIPMENT UTILIZATION
Marvin D. Pipher, P. A. Green, and D. F. Wolfgram 1 May 1975 289 p refs
(Contract NAS9-13970)
(NASA-CR-144460; JSC-09448-Vol-2; JSC-IN-75-FM-14-Vol-2) Avail: NTIS HC $8.75 CSCL 09C

A catalogue is presented of space shuttle electrical equipment as used within a standardized data base for EPS consumables analyses. The general function and expected usage of each type of electrical equipment are described, and the usage of specific equipment of each type in the performance of EPS consumables analyses is defined. Author

N75-32326*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
EFFECTIVENESS OF RECURSIVE FILTERS IN SELECTING MOVING TARGETS
D. I. Popov and V. A. Fedorov Washington NASA Sep. 1975 8 p refs Transl. into ENGLISH from Radioelektronika (USSR), v. 18, no. 3, Mar. 1975 p 63-67
(Contract NASw-2789)
(NASA-TT-F-16547) Avail: NTIS HC $3.25 CSCL 09C

Chebyshev's filters of the 2nd and 3rd order are studied. Benefits in relation to signal/noise gained with recursive filters are estimated. It is shown that the efficiency of the given filters considerably depends on noise selection volume and correlation time. Author

N75-32327# Army Electronics Command, Fort Monmouth, N.J.
DEVELOPMENT OF INTERFACE BETWEEN CAD AND CAM Final Report
David K. Ruppe May 1975 34 p
(AD-A009491; ECOM-4315) Avail: NTIS CSCL 13/8

The development of methods and procedures to interface CAD (computer aided design) and CAM (computer aided manufacturing) for the fabrication of printed circuit boards and distributed parameter devices was performed by this task. An in-house capability for design fabrication and validation of printed circuit boards and distributed parameter microwave devices was implemented. GRA

N75-32328# Microwave Applications Group, Chatsworth, Calif.
MICROWAVE RECIPROCAL LATCHING FERRITE PHASE SHIFTERS Final Report
Charles R. Boyd, Jr. Mar. 1975 189 p refs
(Contract DAAB07-73-C-0039; DA Proj. 1S6-62705-AD-92)
(AD-A009505; ECOM-0039-F) Avail: NTIS CSCL 09/5

The report describes analytical and experimental investigations carried out on dual-mode, reciprocal, latching ferrite phase shifters, with special emphasis placed on low insertion loss and low potential cost for production quantities. Analytical work has been directed at providing design limit and tradeoff information that may be of value to the system designer as well as to the phase shifter designer. Experimental models have been built at S-band and C-band using lithium-titanium ferrite materials. The most favorable frequency region for the dual-mode phase shifter extends from about 5 GHz to about 20 GHz. Bandwidths up to 10 percent can be obtained with moderate phase shift dispersion, and the greatest practical bandwidth appears to be on the order of 30 percent. Insertion loss at or below 1.0 db is readily achievable. GRA

N75-32329# Naval Electronics Lab. Center, San Diego, Calif.
MILLIMETER WAVES TECHNIQUES CONFERENCE, VOLUME 1
Mar. 1974 290 p refs Conf. held at San Diego, Calif., 26-28 Mar. 1974
(AD-A009512; NELC/TD-308-Vol-1) Avail: NTIS CSCL 09/5

Conference was held on millimeter wave techniques; papers given at the conference are presented. Topics discussed include solid state devices and components, antennas and propagation, and communication circuits and components. Author (GRA)

N75-32330# GTE Sylvania, Inc., Needham Heights, Mass.
EXTENDED SCEPTRE. VOLUME 1: USER'S MANUAL Final Report, 15 May 1972 - 30 Jun. 1974
David Becker Dec. 1974 248 p refs
(Contract F29601-72-C-0093)
(AD-A009594; AFWL-TR-73-75-Vol-1) Avail: NTIS CSCL 09/5

Volume 1 of Extended SCEPTRE covers circuit preparation and entry and describes the use of the special program options, including: Stored model; re-output, continue and rerun; the sub-program capability; and the various print and plot options. Examples of the use of the old and new features are given. Separate chapters contain system information for using SCEPTRE on the 7090/94 and S/360 machines. CDC 6600 system information and additional notes to the user are contained in volume 1, appendixes G and H respectively. GRA

N75-32331# GTE Sylvania, Inc., Needham Heights, Mass.
EXTENDED SCEPTRE. VOLUME 2: MATHEMATICAL FORMULATION Final Report, 15 May 1972 - 30 Jun. 1974
David Becker Dec. 1974 112 p refs
(Contract F29601-72-C-0093)
(AD-A009595; AFWL-TR-73-75-Vol-2) Avail: NTIS CSCL 09/5

Volume 2 of Extended SCEPTRE covers the following subjects pertinent to the dc, ac, and transient solutions: Treatment of matrices including sparse matrices, sources and source derivatives, integration routines including implicit integration, and dc option mathematics and the adjoint network. GRA

N75-32332# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATED CONTROL SYSTEM IN ELECTRICAL ENGINEERING
A. K. Antonov 16 Jan. 1975 13 p Transl. into ENGLISH from the book "Avtomatizirovannye Sistemy Upravleniya" USSR, 1972 p 53-57
(FTD Proj. T74-05-02)
(AD-A006829; FTD-HT-23-0793-75) Avail: NTIS CSCL 09/1

The development of automated control systems and the use of computers in production technology were investigated. Topics discussed include systems engineering, human factors engineering, economic analysis, and computer technology. M.J.S.

N75-32333# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
HIGH-PRESSURE MERCURY VAPOR LAMPS, WHITE SANDS MISSILE RANGE, NEW MEXICO Final Report
Wesley J. Marshall Apr. 1975 13 p
(AD-A010338; USAEHA-42-144-75) Avail: NTIS CSCL 06/18

A radiation protection special study on a bank of 320 high-pressure mercury vapor lamps was performed at White Sands Missile Range. Measurements revealed that actinic ultraviolet radiation exposure was the limiting factor in determining exposure of the skin and eyes of personnel working beneath the array of lamps. Hazardous exposure conditions would be encountered when personnel remained in the chamber for periods in excess of approximately four minutes. GRA

N75-32334# Radio Corp. of America, Burlington, Mass. Government Communications and Automated Systems Div.
PRODUCTION ENGINEERING MEASURES: AUTOMATIC ASSEMBLY OF HYBRID INTEGRATED CIRCUITS Quarterly Progress Report, 1 Aug. - 31 Oct. 1974
D. R. Bokil 15 Jan. 1975 59 p refs
(Contract DAAB05-73-C-2039)
(AD-A010386; QPR-3) Avail: NTIS CSCL 09/5

Effort was initiated to develop automatic techniques and equipment capable of mass production of thick film hybrid integrated circuits. The amplifier trigger circuit, Army Part Number 11715226, used in the XM734 multi-option fuse has been

selected as the assembly which will serve as the test vehicle. GRA

N75-32335# Stanford Research Inst., Menlo Park, Calif.
EFFECTS OF STRESS ON THE ELECTRICAL RESISTANCE OF YTTERBIUM AND CALIBRATION OF YTTERBIUM STRESS TRANSDUCERS Final Report, 13 Mar. 1972 - 13 Jul. 1973
Michael J. Ginsberg, Dennis E. Grady, Paul S. DeCarli, and John T. Rosenberg Aug. 1973 143 p refs
(Contract DNA001-72-C-0146; ARPA Order 1695; SRI Proj. PYU-1797)
(AD-A010262; DNA-3577F) Avail: NTIS CSCL 14/2

The effect of dynamic compressive stress on the electrical resistance of 0.005 cm (2 mil) thick ytterbium foil was studied over the range 0 to 33.40 kbar. This material has been used successfully as the active element in dynamic stress transducers with major application to in situ geological measurements and laboratory measurements in inhomogeneous materials. GRA

N75-32336# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
A PARALLEL-CHANNEL DETECTION SYSTEM
P. C. Black, P. J. Kindlmann, W. Nagorski, and R. K. Chang May 1975 99 p refs
(Contract N00017-67-A-0097-0005; NR Proj. 396-1012)
(AD-A010202; TR-17) Avail: NTIS CSCL 14/2

The report covers the development of a parallel-channel detection system (PCDS) for use in low light level spectroscopy. The PCDS consists of a three-stage image intensifier and an image isocon television camera. Fiber-optics coupling of the image intensifier to the camera and careful video processing have yielded quantum-limited sensitivity. Modifications to the basic detector have resulted in improvements in resolution, uniformity, and dynamic range. The data acquisition time for the current PCDS is approximately 100:1 less than that of a conventional photomultiplier tube detector. Tests are being conducted in order to completely characterize the operation of the PCDS and further improve its performance. GRA

N75-32337# Naval Research Lab., Washington, D.C.
PHASED-ARRAY ANTENNA ANALYSIS FOR PACIFIC MISSILE RANGE INSTRUMENTATION AIRCRAFT
J. B. L. Rao and J. K. Hsiao 15 Oct. 1974 60 p refs
(NRL Proj. R02-24)
(AD-A000952; NRL-7806) Avail: NTIS CSCL 09/5

Conformal phased arrays for Extended Area Tracking System (EATS), Target Control System (TCS), and Telemetry System (TMS) are analyzed using computer simulation when they are located on a P-3 aircraft. First, the radiation patterns are obtained by assuming that the array elements are uniformly spaced around the curved surface, and the exact phase is used to scan the beams. To simplify the phase control, a method is discussed by which the phase control is approximated by a planar array, row-column steering. The radiation patterns are obtained using the approximate technique and compared with those obtained by using correct phase control. The results indicate that the approximate phasing can be used witH EATS and TCS arrays with negligible degradation in array performance. For TMS arrays, the simple row-column steering introduces unacceptable phase errors. For such arrays, a modified approximate phasing is recommended. GRA

N75-32338# Collins Radio Co., Newport Beach, Calif.
DESIGN AND DEVELOPMENT OF MOS SCALER INTEGRATED CIRCUIT Final Report, Oct. 1972 - Oct. 1973
John J. Peterson Aug. 1974 124 p refs
(Contract DAAG39-73-C-0050; HDL Proj. 653200)
(AD-A000905; Rept-765-5271-001; HDL-TR-050-1) Avail: NTIS CSCL 09/5

The report discusses verification of the logic design, design of the MOS circuit, layout of the MOS chip, manufacturing of the MOS chip and testing. GRA

N75-32339# Naval Postgraduate School, Monterey, Calif.
MODELLING UHF ANTENNA COUPLING ON AIRCRAFT M.S. Thesis
Richard Evans Koeler Mar. 1975 59 p refs
(AD-A009968) Avail: NTIS CSCL 09/5

Antenna coupling is of particular interest on aircraft where the structure interacts with the antenna arrays. These arrays may be extremely complex as new electronic countermeasures and signal intelligence systems are added to aircraft. The thesis attempts to find a method to predict such antenna interactions. Four general computer programs for antenna design and radiation pattern determination are investigated and deficiencies and strengths noted. These programs primarily employ the moment method or geometrical theory of diffraction. Some interesting correlations are presented and recommendations on future potentially fruitful approaches are discussed. GRA

N75-32340# Army Electronics Command, Fort Monmouth, N.J.
ANALOG NETWORK REPRESENTATION OF INTERDIGITAL SURFACE WAVE TRANSDUCERS
Arthur Ballato May 1975 12 p refs
(AD-A010332; ECOM-4322) Avail: NTIS CSCL 09/1

Analog networks for surface waves are introduced and illustrated. Transmission lines represent regions of propagation, and piezoelectric transduction appears as ideal transformers at electrode edges producing delta-functions of traction. Advantages of using an analog-type description are discussed. GRA

N75-32341# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INTEGRATED OPTICAL CIRCUITS Semiannual Technical Summary Report, 1 Jan. - 30 Jun. 1974
Ivars Melngailis 30 Jun. 1974 31 p refs
(Contract F19628-73-C-0002; ARPA Order 2074)
(AD-A006813; ESD-TR-75-103) Avail: NTIS CSCL 09/1

Electroabsorption avalanche photodiodes fabricated in high purity n-type epitaxial GaAs are examined along the attenuation of high purity planar GaAs waveguides at weightlengths close to the absorption edge. The ability to selectively grow HgI-xCdxTe on CdTe substrates by SiO2 masking is demonstrated using the hydrogen transport epitaxial technique. Detailed measurements made of mode propagation at 10.6 micrometers in n/n+CdTe planar waveguides formed by proton bombardment are given. Bragg-type acoustic-optic modulators using Rayleigh surface acoustic waves were fabricated in such n/n+CdTe waveguides and a modulation efficiency for obtained at 27 MHz with about 0.5 W of acoustic power. Planar waveguides with propagation losses less than or equal to 1.5 cm-1 (6.5 dB/cm) at 10.6 micrometer wavelength were fabricated in the PbI-xSnxTe alloy system for eventual use in integrated 10.6 micrometer heterodyne receivers. Author

N75-32342# Raytheon Co., Sudbury, Mass.
EVALUATION OF TWO DIMENSIONAL HF ADAPTIVE ANTENNA ARRAYS Final Technical Report
R. L. St.Germain, H. R. Alexander, and G. D. Thome Oct. 1974 87 p refs
(Contract F30602-73-C-0265; ARPA Order 2385)
(AD-A001088; ER74-4272; RADC-TR-74-281) Avail: NTIS CSCL 09/5

The primary task was to modify an existing HF phased array facility in Hudson, Colorado so that data could be collected on a large two-dimensional array in a format suitable for use for adaptive processing. The principal modifications included the construction of a 32 element cross array of vertical monopoles and the addition of quadrature outputs to the existing 32-channel receiver and data acquisition system. Additional tasks included the development of software (for controlling the data collection system, for processing and displaying the field data, for producing simulated field tapes for specific array geometries and model environments), data collection under a variety of conditions, and analysis of (numerical simulations to guide the design of the antenna array and data reduction to evaluate the performance improvement obtained through adaptive processing). GRA

N75-32343# Michigan Univ., Ann Arbor. Electron Physics Labs.
OPERATING CHARACTERISTICS OF IMPATT DIODES
J. R. East Oct. 1974 96 p refs
(Contract F30602-74-C-0012)
(AD-A002662; TR-131; RADC-TR-74-255) Avail: NTIS CSCL 09/11

The purpose of the study is to investigate the operation of IMPATT diode oscillators with a variety of doping profiles and to compare the experimental operating results with those predicted from theory. In order to accomplish the objective, a method of diode fabrication was developed which allowed a variety of different diode structures to be fabricated and experimentally evaluated. Various experimental and computer techniques were used to characterize the diodes. These methods allow the diode impurity profile to be determined and indicate the thermal operating limits of the devices. The experimental work on the fabricated diodes with known impurity profiles is also described. Several differences in the operation of n(+)pp(+) and p(+)nn(+) diodes with varying structures are discussed and compared with theoretically predicted results. GRA

N75-32344# Avco Corp., Lowell, Mass. Systems Div.
SPIN SENSOR ARMING DEVICE QUALIFICATION PROGRAM Final Report
V. Suozzo Apr. 1975 52 p
(Contract DAAA21-73-C-0754)
(AD-A010393; AVSD-0362-74-RR) Avail: NTIS CSCL 19/1

A qualification program was conducted on the Spin Sensor Arming Device during which 40 units were fabricated and assembled, 34 were scheduled for a series of tests, and 32 were tested. Environmental tests on the first seven units clearly indicated problems with the Limit and Zero Stops. Engineering tests were conducted to evaluate new stop designs. Sixteen units with new stop configurations were successfully tested. Two additional units were flight tested on the E2-2 test vehicle with complete success. The Reliability and Safety Analysis was updated reflecting the changes to the arming device. GRA

N75-32345# Picatinny Arsenal, Dover, N.J.
USER'S MANUAL FOR PCBOARD Final Report
Ralph E. Lombardi Jan. 1975 108 p
(AD-A010313) Avail: NTIS CSCL 09/5

PCBOARD is Super Tool, digital computer program used to design the layouts of printed circuit boards. Not a substitute for printed circuit layout experience, it rather provides the designer with the use of an interactive graphics terminal functioning as an electronic drafting board. Layouts can be generated on the face of the graphics screen thru the optimum placement of components and construction of the conductor paths interconnecting their common leads. A computer driven plotter produces inked drawing copies of the completed screen layout or when equipped with an optical exposure head this same plotter can produce an actual size artwork master of the conductor pattern directly on photographic film for use in the manufacture of the board. GRA

N75-32346# New Mexico State Univ., University Park. Physical Science Lab.
RESEARCH AND DEVELOPMENT OF ANTENNAS FOR ROCKET AND SATELLITE TRANSMISSIONS Final Report, Feb. 1972 - Jan. 1975
Alexander Waterman and Dennis G. Henry Mar. 1975 10 p refs
(Contract F19628-72-C-0065; AF Proj. 7659)
(AD-A010456; PSL-PR00814; AFCRL-TR-75-0181) Avail: NTIS CSCL 09/5

The studies include development of telemetry, beacon and other antenna designs in various frequency bands. Many different mechanical configurations for rockets and satellites were developed under direction of the contracting officer. The most significant development was in the field of stripline antennas for which a patent is pending. GRA

N75-32347# Wisconsin Univ., Madison. Mathematics Research Center.
PULSE PROPAGATION ON AS SUPERCONDUCTIVE NEURISTOR Technical Summary Report
Stanley A. Reible and Alwyn C. Scott Feb. 1975 58 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GK-37552)
(AD-A010090; MRC-TSR-1422) Avail: NTIS CSCL 09/1

Both analytic study and experimental investigations on an electronic analog are presented which indicate the unstable nature of Parmentier's traveling wave pulse on a superconductive neuristor. In the vicinity of a critical bias level, the pulse is almost stable in the sense that pulse distortion over a finite distance can be made arbitrarily small by adjusting the bias to be sufficiently close to the critical value. It is also shown that the strength-duration curve for threshold excitation can be obtained by equating input magnetic flux to that of Parmentier's pulse. Finally an R - T junction has been realized by resistive coupling of two neuristor lines and used to introduce a circulating pulse onto a storage ring. GRA

N75-32348# Silicon Transistor Corp., Chelmsford, Mass.
PRODUCTION ENGINEERING MEASURE FOR HIGH CURRENT, FAST-SWITCHING TRANSISTORS Quarterly Progress Report, 19 Oct. 1974 - 14 Jan. 1975
Frederick G. Ernick Apr. 1975 104 p
(Contract DAAB05-73-C-2032)
(AD-A010316; QPR-8) Avail: NTIS CSCL 09/1

During the period, First Article Testing was successfully completed. The First Article Samples and the First Article Test Report were submitted for approval. The First Article Test Report showing the tests performed and the results obtained is included as part of this report. GRA

N75-32349# Physics International Co., San Leandro, Calif.
MODULAR FAST CAPACITOR BANK Final Report, May 1973 - Jun. 1974
P. D. A. Champney Apr. 1975 117 p refs
(Contract F29601-73-C-0111)
(AD-A010042; PIFR-555) Avail: NTIS CSCL 10/3

The report describes the development of a fast capacitor bank module storing 55 kJ at 100 kV dc, capable of operating by itself or as part of a larger system. The module is gasketed and uses two triggered gaseous dielectric rail switches operable over the voltage range 15 to 50 kV dc. The module inductance is 8 nH. GRA

N75-32350# Stanford Univ., Calif. High Energy Physics Lab.
THE SUPERCONDUCTING-CAVITY STABILIZED OSCILLATOR AND AN EXPERIMENT TO DIRECT TIME VARIATION OF THE FUNDAMENTAL CONSTANTS
S. R. Stein Oct. 1974 111 p refs
(Contract N00014-67-A-0112-0076)
(AD-A002479; SU-HELP-741) Avail: NTIS CSCL 09/5

A precision microwave oscillator system was developed which has a superconducting cavity as its frequency determining element. The frequency stability of the device, called the superconducting-cavity stabilized oscillator (SCSO), was studied using both spectrum analysis and period measurement techniques. For times shorter than one-thousand seconds the frequency fluctuations, as measured by the Allan variance, are smaller than for any other high stability frequency source; the noise floor of the fractional frequency fluctuations is 10 to the minus 16th power at the present time. The long term performance of an ensemble of SCSO systems has been measured relative to the frequency of a cesium-beam frequency standard. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N75-32351 Notre Dame Univ., Ind.
A NONLINEAR APPLICATION OF THE STABILIZED MARCH TECHNIQUE TO A PROBLEM OF FLUID FLOW Ph.D. Thesis
Peter Frederick Riehm 1975 146 p
Avail: Univ. Microfilms Order No. 75-19952

The Stabilized March Technique (SMT), a matrix solution technique for boundary value problems, is applied to nonlinear equations. The system of equations considered consists of the steady-state, two-dimensional vorticity transport equation, coupled with the streamfunction equation. Both are elliptic and are solved successively by the same SMT algorithm. The SMT expands a

solution as a sum of a homogeneous and an inhomogeneous term. The homogeneous term is constrained to satisfy the homogeneous portion of the equation, while the inhomogeneous term satisfies the whole equation. The homogeneous portion is expanded in a set of linearly independent expansion vectors to which a periodic conditioning transformation is applied. This transformation serves to stabilize the march by limiting round-off error and restoring the linear independence of the set of expansion vectors. A solution to a given equation is obtained directly after two sweeps through the mesh, first at the points of conditioning and then at the finer mesh points between these points of conditioning. Dissert. Abstr.

N75-32352 Ohio State Univ., Columbus.
AN INVESTIGATION OF THE INFLUENCE OF SOUND ON FLOW STABILITY, FLAME NOISE AND NITROGEN OXIDE LEVELS IN NATURAL GAS FLAMES Ph.D. Thesis
Robert Alois Knezek 1975 331 p
Avail: Univ. Microfilms Order No. 75-19458

An experimental study was conducted to determine the influence of applied sound on flow stability, flame noise, and nitrogen oxides in premixed natural gas flames. Flow stability of diffusion flames was also investigated. Applied sound fields were investigated for the range of 8 to 32,500 Hz and sound levels up to 100 db. Sound fields applied upstream of the burner nozzle were effective in disturbing the flame whereas sound fields external to the burner flame system were ineffective. An analytical model for flame amplification of upstream noise was developed. It is concluded that sound fields applied upstream of the flame influence flow stability, flame noise, and nitrogen oxides. Noise originating upstream of the flame may control flame noise in many low-noise burner applications. Noise fields can also vary nitrogen oxide production up to 30 percent. Noise at frequencies that do not induce mixing in the flame can increase nitrogen oxides up to 20 percent. Dissert. Abstr.

N75-32353 California Inst. of Tech., Pasadena.
ENGINEERING, HEAT AND THERMODYNAMICS: SECOND SOUND ATTENUATION IN A LIQUID HELIUM COUNTER-FLOW JET Ph.D. Thesis
Glenn Alan Laguna 1975 92 p
Avail: Univ. Microfilms Order No. 75-19999

The attenuation of a beam of high frequency second sound traversing a counterflow jet in liquid helium was measured in the temperature range 1.6 to 2.06 K. Combined use of thin film superconducting thermometers with specially developed low noise amplifiers allowed a temperature resolution of better than one part in 10 K. The additional attenuation due to the jet was found to be less than 10 percent of the predicted value using the theory of mutual friction in a supercritical counterflow, and consistent with the result of earlier temperature gradient and ion beam attenuation measurements. Dissert. Abstr.

N75-32354 Notre Dame Univ., Ind.
ELECTROSTATIC COOLING OF METALS AND NON-METALS Ph.D. Thesis
Chung-Ping Han 1975 157 p
Avail: Univ. Microfilms Order No. 75-19937

The augmentation of heat dissipation was observed from heated objects in an electrostatic field. Test results show that the cooling rate and the surface temperature distributions are different from material to material. It is also observed that in the vacuum, there is no cooling effect for the nonmetallic plates, but minor cooling is detected for the metallic plates. The above phenomena as well as the surface temperature of various materials under the effect of electrostatic cooling were investigated. The controversy of the mechanisms of the electrostatic cooling phenomenon is discussed. An analytical formulation of the local heat transfer coefficient on a heated horizontal plate and the numerical calculation of the surface temperature are presented. Dissert. Abstr.

N75-32355 Carnegie-Mellon Univ., Pittsburgh, Pa.
TWO DIMENSIONAL LINEARIZED VISCOUS FLOWS Ph.D. Thesis
Martin A. Leonardo 1975 149 p
Avail: Univ. Microfilms Order No. 75-19853

The linearized motions are investigated of a viscous, uncompressible fluid in two dimensions using Laplace transform techniques. The existence of the transformed solution is established using the techniques of classical potential theory. Expansions are found for the transformed velocity for both large and small values of s, the transform parameter. The large s expansion is used to prove the existence of the inverse transform. The small s expansion is used to study the flow velocity for large time. It is shown that the linearized time dependent flows approach steady state flows very slowly as time approaches infinity. Dissert. Abstr.

N75-32356 Duke Univ., Durham, N.C.
AN ANALYSIS OF TURBULENT FLUID FLOW AND HEAT TRANSFER FOR VEHICLES TRAVELING IN TUBES Ph.D. Thesis
Ish Sud 1975 199 p
Avail: Univ. Microfilms Order No. 75-19179

The flow in the annular gap between a moving vehicle and a tunnel wall is examined. The turbulent flow and turbulent energy equations for this region are solved in order to calculate the aerodynamic drag and study the associated thermal effects. The energy equation is written neglecting viscous dissipation terms, and assuming a uniform volumetric heat generation in the annular gap equivalent to the energy dissipation. The turbulent fluid flow in the annular gap and the associated thermal boundary layers are divided into developing and fully developed regions. Integral boundary layer solutions and the momentum equation are used in the analysis. The shear stresses and pressure gradient obtained are used to calculate the energy requirements and the resulting heat generation within the annular contents. A boundary layer type solution is obtained for the simultaneously developing hydrodynamic and thermal profiles. Dissert. Abstr.

N75-32357 Florida Univ., Gainesville.
STUDY ON THE STRUCTURE OF TURBULENT SHEAR IN WALL NEAR LAYERS Ph.D. Thesis
Richard Rushby Johnson 1974 193 p
Avail: Univ. Microfilms Order No. 75-19349

Experimental studies were conducted on fully developed turbulent flows of water in a pipe of circular cross section by employing two different measuring techniques: flow visualization by trace particles, and hot-film anemometry. The two techniques demonstrate different descriptive approaches to self-preserving wall turbulence. By hot-film anemometry, the flow field is explored point by point and the turbulence described in terms of average velocities and velocity correlations measured at these points, whereas by the trace-particle flow visualization, the instantaneous three-dimensional velocity field is mapped out in space and time. Dissert. Abstr.

N75-32358 Florida Univ., Gainesville.
STABILITY OF HETEROGENEOUS SWIRLING FLOWS Ph.D. Thesis
Yee-tak Fung 1974 209 p
Avail: Univ. Microfilms Order No. 75-19334

A general mathematical investigation is presented of the hydrodynamic stability of heterogeneous swirling flows with possible applications to the gaseous centrifuge method for separation of uranium isotopes and to the proposed vortex-driven gas-core nuclear reactor. The flow under consideration is assumed to be inviscid and incompressible but has radially dependent density and velocity components within an annular region between two concentric cylinders. The concept of 'centrifugal stability' is introduced to distinguish instabilities caused by centrifugal forces due to rotation of the flow from those caused by shearing effects due to the relative motion between tow adjacent fluid layers. Extensions of Howard's semi-circle theorem were obtained for four types of swirling flows with centrifugally stable velocity and density distributions. Four types of velocity and density profiles are examined analytically, and exact solutions expressed in terms of the modified Bessel functions were obtained. Dissert. Abstr.

N75-32359 Michigan Univ., Ann Arbor.
CONVECTIVE INSTABILITY OF A FLUID LAYER WITH TIME-PERIODIC TEMPERATURE DISTRIBUTION Ph.D. Thesis
Yasuo Fujita 1975 83 p
Avail: Univ. Microfilms Order No. 75-20348

The effects of the time-periodic temperature distribution on the variation of the stability boundary were examined. Three basic configurations for the steady part are chosen: (1) same temperatures at the upper and lower boundaries, (2) the linear temperature distribution, and (3) the temperature distribution caused by a homogeneous heat source. Four typical temperature distributions for the time-periodic part were examined: (1) symmetric, (2) anti-symmetric, (3) mixed, and (4) due to the time-periodic heat sources. All the time-periodic parts are sinusoidal functions of time. Superposition of a time-periodic part on a steady part makes a complete primary temperature distribution the stability of which is examined. Both linear and nonlinear theories are applied to these problems. Dissert. Abstr.

N75-32360 New Jersey Inst. of Technology, Newark.
EFFECT OF GAS TEMPERATURE GRADIENTS AND RADIANT HEAT TRANSMISSION ON KINETIC MODEL BEHAVIOR Ph.D. Thesis
Richard Walter J. Robertson 1974 329 p
Avail:. Univ. Microfilms Order No. 75-12795

Kinetic models are strongly temperature dependent with a difference of 10 K able to double the reaction rate. Calculation techniques which make allowance for the nonuniformity of gas temperatures in an enclosure are applied to the kinetic models. The furnace problem considers only the radiation section with the assumption that detailed knowledge of combustion and fluid flow pattern within the enclosure is available. The primary result was the application of radiant dominant heat transmissions in enclosures (which make allowances for temperature nonuniformity in gas mass) to a pyrolysis reactor. The result of this reactor-furnace hybrid model is the ability to determine optimum tube placement, furnace size, and fuel consumption, while accounting for the effect of carbon deposition in the reactor. The methods developed were instrumented on an IBM 370-15 computer. This machine made it possible to make parametoric studies which predict the effect of changing furnace and reactor variables. Dissert. Abstr.

N75-32361 California Inst. of Tech., Pasadena.
EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF OSCILLATIONS IN FLOWS OVER CAVITIES Ph.D. Thesis
Virendra Sarohia 1975 128 p
Avail: Univ. Microfilms Order No. 75-20011

Laminar axisymmetric flows over shallow cavities at low subsonic speeds were experimentally investigated using constant-temperature hot-wire-anemometry. The study included: study of the effect of the free-stream and cavity configuration on onset of cavity oscillations; measurements of cavity shear layer under a wide range of cavity and flow configurations; and the distribution of the phase of the propagating disturbances during both first and second mode of cavity oscillation for a fixed Reynolds number at the upstream corner. Both motion and instant pictures of cavity shear flow, visualized by smoke injection, were obtained. Experiments were also done to investigate the effect of artificial excitation and of mass injection on the onset of cavity oscillations. Dissert. Abstr.

N75-32362 California Inst. of Tech., Pasadena.
AN EXPERIMENTAL INVESTIGATION ON FOCUSSING OF WEAK SHOCK WAVES IN AIR Ph.D. Thesis
Vijay Anand Kulkarny 1975 108 p
Avail: Univ. Microfilms Order No. 75-19998

The behavior of focussing weak shock waves was experimentally investigated with a view to observe and understand the processes occurring near the focus, especially the processes that control the maximum amplitude. Concave reflectors are used against the endwall of a large 17 inch diameter shock tube, to focus the plane incident shock. Reflectors producing line and point foci, and cusped and smooth caustics were examined for incident shock Mach numbers ranging between 1.005 to 1.5. The flowfield is observed with spark shadowgraphs to visualize the motion of various wavefronts. Pressure histories measured at various points in the flow with miniature piezoelectric gauges provide additional information about the various processes occurring near the focus. Dissert. Abstr.

N75-32363 Pennsylvania State Univ., University Park.
CRITICAL HEAT FLUXES FOR CURVED AND STRAIGHT SURFACES DURING SUBCOOLED FLOW BOILING Ph.D. Thesis
Thomas George Hughes 1974 157 p
Avail: Univ. Microfilms Order No. 75-19773

A total of 274 experiments were conducted at five mean velocities and four subcoolings. The analytical study and the experimental data indicate that for equal velocity and subcooling, concave surfaces sustain larger critical heat fluxes than straight surfaces which, in turn, sustain larger critical heat fluxes than convex surfaces. An idealized vapor bubble cycle was defined and is used as the basis for a critical heat flux model. In the model, vapor bubbles are assumed to depart from the heated surface when they have grown to the edge of the hydrodynamic sublayer. The frequency of the idealized vapor bubble cycle was derived and combined with expressions for the energy associated with each vapor bubble cycle and the number of active sites present to produce a critical heat flux expression. The resulting expression contains only one empirical constant. Dissert. Abstr.

N75-32364 Michigan Univ., Ann Arbor.
HEAT TRANSFER, FLOW FRICTION, NOISE AND VIBRATION STUDIES OF PERFORATED SURFACES Ph.D. Thesis
Cho Ying Liang 1975 142 p
Avail: Univ. Microfilms Order No. 75-20393

A systematic investigation was conducted to study perforated plate surfaces which find important application compact heat exchanger design either as primary or secondary heat transfer surfaces. It was concluded that surface perforation results in enhanced heat transfer and flow friction performance only in the transition and turbulent flow regimes. The enhancement is due to the combined effects of boundary layer interruption due to perforations, expedition of transition from laminar to turbulent flow, and the disruption of the thermal boundary layer. The last two factors are caused by the penetration of Karman vortices shed periodically from the perforations. It was also found that vortex shedding is the major mechanism causing the flow-induced noise and vibration problem. The observed resonance phenomena at certain Reynolds number is due to standing waves being set up in the air column transverse to both the fluid flow direction and the perforated plate surfaces. Based on the results obtained, guidelines for practical heat exchanger design were recommended. Dissert. Abstr.

N75-32365 Carnegie-Mellon Univ., Pittsburgh, Pa.
DYNAMICS OF WETTING PROCESSES Ph.D. Thesis
Jaime Lopez 1975 166 p
Avail: Univ. Microfilms Order No. 75-19856

Fluid mechanics were analyzed for some wetting processes using a new mechanism for the origin of flow near a contact line. The basic idea is that intermolecular forces can generate flow in the immediate vicinity of the contact line. The direction and detailed pattern of the flow depends on the difference between the actual and equilibrium configurations of the fluid interface near the contact line. For the special case of equilibrium, equations yield results in reasonable agreement with existing theoretical and experimental findings about equilibrium contact angles for various liquids on the same solid surface. Confidence in the theory's predictions for dynamical situations is thus strengthened. Lubrication theory was used to simplify the equations of motion. Dissert. Abstr.

N75-32366 Mississippi State Univ., State College.
NUMERICAL SOLUTION OF THE INCOMPRESSIBLE NAVIER-STOKES EQUATIONS ABOUT ARBITRARY TWO-DIMENSIONAL BODIES Ph.D. Thesis
Frank Critz Thames 1975 205 p
Avail: Univ. Microfilms Order No. 75-20737

A method of automatic numerical generation of general curvilinear coordinate system having a constant coordinate line coincident with each boundary of a general multi-connected physical flow region was developed. These curvilinear coordinates are generated as the solution of two elliptic partial differential equations with Dirichlet boundary conditions. Once the natural coordinates are generated for a given physical domain, the vorticity-stream function formulation of the Navier-Stokes equations are transformed to the rectangular transformed plane. The equations were approximated using central differences for

the space derivatives and a backward first-order time difference for the vorticity time derivative. The flow solution is carried out by an implicit method with SOR iteration being used to converge the elliptic space variation at each time step. The vorticity distribution on the body surface is calculated at each time step utilizing a modified multi-dimensional false position iteration designed to force the tangential velocity component on the body surface to zero. Dirichlet conditions corresponding to irrotational flow were used at the remote boundary. Dissert. Abstr.

N75-32367 California Inst. of Tech., Pasadena.
THE MOTION AND ASSOCIATED MASS TRANSFER CHARACTERISTICS OF GAS BUBBLES IN VISCOELASTIC LIQUIDS Ph.D. Thesis
Erdinc Zana 1975 184 p
Avail: Univ. Microfilms Order No. 75-20015

Full numerical and approximate analytical solutions are obtained for Pe much less than 1 case in order to investigate the roles of shear viscosity, relaxation and retardation times, surface tension, and the Henry's law constant on the dissolution rate. It is shown that the collapse characteristics and the behavior of internal pressure in the viscoelastic liquid differ considerably from the case of a purely Newtonian liquid, particularly during the early and late stages of the dissolution process. The Pe much less than 1 case is studied experimentally. The mass transfer rates from gas bubbles rising in viscoelastic liquids are measured and the data are shown to correlate very well with Weissenberg number. It is also shown that mass transfer rate from a gas bubble is greatly enhanced by viscoelasticity over its value for a Newtonian liquid with the same shear viscosity. Dissert. Abstr.

N75-32368 California Inst. of Tech., Pasadena.
COMBINED FORCED AND FREE CONVECTION IN STRATIFIED AND UNSTRATIFIED FLOWS Ph.D. Thesis
Grant Earl Robertson 1975 171 p
Avail: Univ. Microfilms Order No. 75-2009

The laminar, steady, horizontal flow past a hot or cold two-dimensional body is examined; the fluid is unbounded, diffusive, and viscous. The presence of significant ambient stable temperature (or density) stratification, or significant buoyancy-induced convection, or both, is considered. A detailed understanding of the fundamental structure of such flows is obtained by developing effective analytical and numerical solution procedures. Dissert. Abstr.

N75-32369 Princeton Univ., N.J.
AN EXPERIMENTAL STUDY OF THE FLOW OF NEWTONIAN AND NON-NEWTONIAN LIQUIDS NEAR A STAGNATION POINT Ph.D. Thesis
Lewis S. Smith 1974 360 p
Avail: Univ. Microfilms Order No. 75-20663

The axisymmetric stagnation flows of moderately viscous Newtonian and viscoelastic liquids were examined experimentally at 25 C. The stagnation flow was generated by vertically impinging a free jet of liquid downward onto a stationary, horizontal glass disc. Measurements of velocity profiles and fluid streamlines were made for a fixed flow rate and jet tube. A photomicrographic, stereoscopic flow-visualization technique was developed which used chopped light scattered from tracer particles in the fluid to reveal the flow patterns. Substantial differences between classical theory and the present experiments were found for the Newtonian fluid in the form of an unpredicted maximum in the radial velocity profile and an attendant inflection in the axial velocity profile. In consonance with prior theoretical and experimental investigations of viscoelastic wedge flows, of which stagnation flow is a special case, the experimental data for the viscoelastic fluid indicated the existence of a stagnant fluid region near the stagnation point which was not present in the Newtonian flow. Dissert. Abstr.

N75-32370 State Univ of New York, Buffalo.
INVESTIGATION OF MASS TRANSFER DURING LIQUID-LIQUID EXTRACTION Ph.D. Thesis
Anil Sethy 1975 159 p
Avail: Univ. Microfilms Order No. 75-18841

Diffusion measurements were made using the diaphragm cell technique. The mutual diffusivity of the partially miscible binary system, acetonitrile-n-heptane, was found to be a strong function of concentration. The ternary system, acetonitrile-benzene-n-heptane, was investigated at a number of points so that a general idea of the diffusion coefficient matrix was obtained. The mass transfer experiments were conducted in a stirred extraction cell of the Lewis type, and the transfer between an unsaturated and nearly saturated phase was studied. The mass transfer coefficients for the partially miscible binary system, and for those ternary experiments in which the slope of the operating line was negative were found to be independent of the driving force. A photographic investigation, which employed the schlieren technique, indicated that Marangoni-type instabilities were absent in such systems. In ternary experiments in which the slope of the operating line was positive and above a certain critical value, the mass transfer coefficients decreased as equilibrium was approached. Dissert. Abstr.

N75-32371 Ohio State Univ., Columbus.
INVESTIGATION OF FLUID DYNAMIC INTERACTIONS WITHIN MULTIPLE NOZZLE ARRAYS Ph.D. Thesis
James Joseph Komar 1975 138 p
Avail: Univ. Microfilms Order No. 75-19459

Existing experimental investigations of the shear layers in mixing gas-dynamic and chemical diffusion lasers were analyzed and a simplified experiment was designed to provide definite measurements of pressure, temperature and number density. Geometric design parameters were investigated for coplanar supersonic expansion nozzles having either wedge or contoured wall configurations at a nominal Mach number of 4. The principal experimental diagnostic technique utilized an electron beam generator for the measurement of rotational and vibrational temperatures, as well as number densities, of nitrogen expanded from nominal reservoir conditions of 1/2 atmosphere and 2000 K. Results are presented in the form of distributional profiles across the mixing layer for cases where nitrogen and helium were injected in the shear layer, as well as profiles for the noninjection case. Comparisons were made with theoretical predictions of the shear layer properties and reasonable agreement is found for the noninjection case. Dissert. Abstr.

N75-32372 Ohio State Univ., Columbus.
HEAT ADDITION TO A SUPERSONIC FLOW Ph.D. Thesis
William Cleaver Burson 1975 156 p
Avail: Univ. Microfilms Order No. 75-19418

One supersonic heat addition mode, a weak detonation wave where the thermal wave or flame front is supersonic relative to the heated and unheated gas, was experimentally investigated by simulating it in a gas flow and a water flow. The gas flow weak detonation wave was produced by radio frequency (RF) heating of a supersonic argon flow using an RF coil wrapped around a boron nitride duct. Comparison of the experimental measurements was made with a theoretical analysis. The water flow weak detonation wave was simulated by mass addition to a supersonic water stream. The water flow simulation was performed to determine if it could qualitatively predict what occurs in gas flow heat addition. A quasi-one-dimensional theory based on average properties was developed which can analyze axisymmetric duct flows with wall friction, varying area, heat addition, and mass exchange occurring simultaneously. The theory was used for comparison results. Dissert. Abstr.

N75-32373 Tennessee Univ., Knoxville.
STUDY OF SUBSONIC AND TRANSONIC FLOW SEPARATION-WITH AND WITHOUT UPSTREAM DISTURBANCE Ph.D. Thesis
Chwan Haw Chen 1975 274 p
Avail: Univ. Microfilms Order No. 75-18965

The detailed features of flow separation induced by a forward-facing step in transonic and high subsonic flow were studied. The influences of an upstream disturbance upon the downstream separation were simulated by shallow-cavity models of different depth to length ratios. It was shown that certain upstream disturbances can produce higher separation pressure and skin friction than those related to a single forward-facing step. A separation pressure correlation was established empirically from the cavity flow data. The flow relaxation along the cavity floor was explored by systematic measurements and analysis of surface pressures and velocity profiles. These studies revealed that the flow relaxation started from the floor and spread outward.

The outer layer of the shear flow contained a longer memory carrying the influence of the upstream disturbance to the downstream separation. The law of the wall and the wake was used for the analysis of the velocity distributions and the estimation of the skin friction. Dissert. Abstr.

N75-32374 Delaware Univ., Newark.
SEPARATION AND REATTACHMENT OF A TWO-DIMENSIONAL INCOMPRESSIBLE TURBULENT JET Ph.D. Thesis
Komanduri Venu Gopalacharya 1975 255 p
Avail: Univ. Microfilms Order No. 75-20553

The steady and time-dependent incompressible turbulent mean flow equations are numerically solved for the problem of separation and reattachment of a finite two-dimensional jet issuing parallel to an adjacent plate (sidewall). A finite differencing procedure was utilized in rewriting the governing equations in the finite difference form. The advection (convection)terms are written in the divergence form in the vorticity transport equation, and the upwind or unidirectional differencing scheme is adopted for those terms to obtain stable numerical solutions. Gauss-Seidel iteration method was used to solve numerically, the steady equations, and the alternating direction implicit method is adopted to iterate the time-dependent equations. The results are presented as contour plots of stream function, vorticity, mean resultant velocity, and pressure. The velocity distribution across the jet and the wall pressure distribution are included. The transient flow development obtained from the numerical solutions and the sequential photographs of the surface flow patterns from flow visualization study are compared. Dissert. Abstr.

N75-32375 Kentucky Univ., Lexington.
PSEUDOPLASTIC THIN FILM FLOW Ph.D. Thesis
Vujadin O. Popadic 1974 165 p
Avail: Univ. Microfilms Order No. 75-18506

An experimental and theoretical study was conducted on thin film flow of pseudoplastic, non-Newtonian liquids down a smooth, vertical plate. Also, the stabilizing effect of nonionic surfactants on film flow, and co-current downward gas-liquid film flow were investigated. A boundary layer form of the equation of motion was solved to analyze experimental data on free flow. Satisfactory predictions for mean film thickness and directional effect of pseudoplasticity on friction coefficient were obtained. Predictions for the wave length were unsatisfactory. It was found that an existing equation, developed for stabilizing effects of surfactants on Newtonian thin film could be successfully applied to pseudoplastic films by using zero-shear rate apparent viscosity in place of Newtonian viscosity. In all cases there existed a surfactant concentration for which the stabilizing action was maximized. For co-current gas-liquid downward flow, measured values of pressure drop were up to five times higher than when gas flows alone, and depend highly on liquid shear properties. Dissert. Abstr.

N75-32376 State Univ. of New York, Buffalo.
A PREDICTIVE THEORY FOR THE TRANSPORT PROPERTIES OF MULTI-COMPONENT LIQUIDS Ph.D. Thesis
George Michael Kosanovich 1975 172 p
Avail: Univ. Microfilms Order No. 75-18814

The problem of the variation of multicomponent transport properties (viscosities, diffusivities) with concentration was investigated. A theory to predict these liquid properties from infinitely dilute binary parameters and pure component values was developed. These predictions compared well with quaternary and ternary experimental results as well as the binary relations presented for regular and ideal solutions. The theory is based on the concept of ultimate volume which was explicitly developed to include mixtures. This theory also utilizes self-diffusion equations which are extended to include both thermodynamic nonidealities and multiple species. The theory yields a correlation which has the potential to eliminate the need to make infinitely dilute binary diffusion measurements to use the predictive scheme. Dissert. Abstr.

N75-32377 Princeton Univ., N.J.
A THREE-DIMENSIONAL NUMERICAL STUDY OF TURBULENCE IN HOMOGENEOUS AND CONVECTIVELY UNSTABLE FLUIDS Ph.D. Thesis
Charles Edward Schemm 1974 230 p
Avail: Univ. Microfilms Order No. 75-20659

A simplified set of subgrid scale transport equations was used to compute the stresses in a homogeneous turbulence problem and in a three-dimensional model of thermal convection in the atmosphere. The transport equations are closed by standard approximations; and all terms except those thought to be essential to the large scale dynamics are discarded, leaving prognostic equations to be solved for the subgrid scale energy and the virtual potential temperature variance only. Equations for the Reynolds stresses and the subgrid scale temperature-velocity correlations are considerably simplified and can be solved algebraically. A scale analysis of the full transport equations is offered as partial justification for the present approach in the case of nearly isotropic turbulence. Dissert. Abstr.

N75-32378 Pennsylvania State Univ., University Park.
ON THE INVESTIGATION OF CASCADE AND TURBOMACHINERY ROTOR WAKE CHARACTERISTICS Ph.D. Thesis
Rishi Raj 1974 202 p
Avail: Univ. Microfilms Order No. 75-19919

The constitutive equations for the rotor wake were developed using generalized tensors and a noninertial frame of reference. Analytical and experimental investigation was carried out in two phases; the first phase involved the study of a cascade wake in the absence of rotation and three dimensionality. In the second phase the wake of a rotor was studied. Simplified two- and three-dimensional models were developed for the prediction of the mean velocity profile of the cascade and the rotor wake, respectively, using the principle of self-similarity. The effect was studied of various major parameters of the rotor and the flow geometry on the development of a rotor wake. Laws governing the decay of the wake velocity defect in a cascade and rotor wake as a function of downstream distance from the trailing edge, pressure gradient and other parameters are derived. Experimental investigations on the study of cascade and rotor wake were carried out in a cascade tunnel and axial flow fan facilities. Two and three sensor hot wire probes were used to measure the mean velocity and turbulence quantities of a cascade and a rotor wake. Dissert. Abstr.

N75-32379 Michigan State Univ., East Lansing.
STOCHASTIC REPRESENTATION OF SURFACE ROUGHNESS AND ITS RELATION TO MANNING n FRICTION COEFFECIENT Ph.D. Thesis
Nizar Gurol Dinc 1975 154 p
Avail: Univ. Microfilms Order No. 75-20827

An approach is proposed to define the relationship between the friction coefficient and the surface boundary. Spatial distribution of surface boundary protrusions is related to the resistance to flow. The surface protrusions are assumed to be a realization of a stochastic process with respect to distance. The techniques of autocorrelation and power spectrum analysis were used to describe the process. The power spectrum functions of various surfaces with known n values, were analyzed. For each surface, a parameter, K, exponential decay coefficient, related to the spectrum function, was determined. A parabolic relationship is hypothesized between the decay coefficient and the corresponding Manning friction coefficient. The power spectrum functions of several conveying surfaces commonly encountered in practice were experimentally determined in the laboratory. From their spectrum decay coefficients, corresponding Manning n friction coefficients were predicted by using the parabolic relationship. Dissert. Abstr.

N75-32380# National Aerospace Lab., Tokyo (Japan).
NONEQUILIBRIUM FLOWS OF MONATOMIC AND DIATOMIC GASES BEHIND A NORMAL SHOCK WAVE
Riichi Matsuzaki and Noriaki Hirabayashi Feb. 1975 23 p refs In JAPANESE; ENGLISH summary
(NAL-TR-407) Avail: NTIS HC $3.25

One dimensional, nonequilibrium flow equations for chemically reacting monatomic and diatomic gases behind a strong normal shock wave are formulated and solved numerically. The shock is assumed to have no thickness and the effects of heat conduction, precursor, and radiation are neglected. The ionization-recombination nonequilibrium flow of argon is considered. Species

energy equations for ions, as well as for electrons, are solved together with a rate equation and macroscopic conservation equations. Degree of ionization, electron number density, temperatures of the atomic, ionic, and electronic species, velocity, density, and pressure are calculated in the nonequilibrium flow region. Coupled ionization-recombination, dissociation-recombination, and vibrational nonequilibrium flow of nitrogen is considered. Five species are assumed to exist in the nonequilibrium flow region: N2 N, N2(+), N2(+), and electron. Effects of charge transfer and dissociative recombination are included. An electron energy equation is solved together with species rate equations and macroscopic conservation equations. In contrast to the case of argon, the number densities of N2(+), N(+), and electron, and the vibrational energy of N2 take their maximal values at some position just downstream of the wave front. Author

N75-32381# National Aerospace Lab., Tokyo (Japan).
MONTE CARLO CALCULATION OF THE BURGERS MODEL OF TURBULENCE WITH RANDOM FORCE ACTION
Kiyoshi Yamamoto, Takashi Nakamura, and Iwao Hosokawa Jan. 1975 46 p refs In JAPANESE; ENGLISH summary
(NAL-TR-400) Avail: NTIS $3.75

A Monte Carlo method is applied to obtain numerical solution of the characteristic functional equation which describes the statistical behavior of the one-dimensional, space-limited Burgers model of turbulence with certain kinds of random force action. The random forces are assumed to be stationary in time and Gaussian with zero mean, having various power spectrums. The result shows a turbulence-like behavior of the model flow for a supercritical Reynolds number, but it is found that this model turbulence is somewhat peculiar in the sense that the probability distribution of flow velocity is not only far from Gaussian but also has a few sharp peaks, though it more or less depends on the power of random force. The peculiarity, as compared with long-time behavior of individual solutions of the Burgers model equation for the superciritical Reynolds number R = 100 was discussed. Author

N75-32382*# Pennsylvania State Univ., University Park.
INVESTIGATION OF THE UNSTEADY PRESSURE DISTRIBUTION ON THE BLADE OF AN AXIAL FLOW FAN Semiannual Progress Report, Mar. - Sep. 1975
Robert E. Henderson Oct. 1975 12 p ref
(Grant NGR-39-009-275)
(NASA-CR-119129) Avail: NTIS HC $3.25 CSCL 20D

A major source of the noise generated by high bypass ratio aircraft fan engines is the unsteady pressures (forces and moments) acting on the fan blades. These unsteady pressures are the result of the interaction of the blades with the wakes of upstream blade rows, inlet flow distortions, and inlet turbulence. An experimental system was developed which will permit the measurement of the unsteady pressure distributions; a series of experiments were conducted to investigate these effects, and the results are compared with predictions from existing theoretical analyses. Author

N75-32383*# Stanford Univ., Calif. Dept. of Mechanical Engineering.
THE BEHAVIOR OF TRANSPIRED TURBULENT BOUNDARY LAYERS
W. M. Kays and R. J. Moffat Apr. 1975 114 p refs
(Grant NGR-05-020-134; Contract N00014-67-A-0112-0072; Grants NSF GK-534; NSF GK-2201)
(NASA-CR-119147; HMT-20) Avail: NTIS HC $5.25 CSCL 20D

Experimental and analytical studies of the heat transfer behavior of the turbulent boundary layer are summarized. The principal objective was the acquisition of a reliable data base and its modeling by means of a finite difference computer program. Experimental results are provided to the computer in terms of values and variations of mixing length parameters and turbulent Prandtl numbers. The data base covers a wide range of boundary conditions and free stream conditions. Conditions: free stream velocities, uniform velocity, accelerations at constant K up to relaminarization, and decelerations at constant B, but not including separation; transpiration suction and blowing at constant blowing fraction with stepwise and arbitrary variations; and wall temperature at uniform, stepwise, and arbitrary distributions. It is shown that a single pair of functions suffice to recover all of the data. Both the surface data and the profiles of mean velocity and temperature are predictable with acceptable accuracy. Author

N75-32384*# Bell Aerospace Co., Buffalo, N.Y.
COMOC: THREE DIMENSIONAL BOUNDARY REGION VARIANT, PROGRAMMER'S MANUAL
J. A. Orzechowski and A. J. Baker Washington NASA May 1974 220 p
(Contract NAS1-11214)
(NASA-CR-132449; D9192-954001) Avail: NTIS HC $7.25 CSCL 20D

The three-dimensional boundary region variant of the COMOC computer program system solves the partial differential equation system governing certain three-dimensional flows of a viscous, heat conducting, multiple-species, compressible fluid including combustion. The solution is established in physical variables, using a finite element algorithm for the boundary value portion of the problem description in combination with an explicit marching technique for the initial value character. The computational lattice may be arbitrarily nonregular, and boundary condition constraints are readily applied. The theoretical foundation of the algorithm, a detailed description on the construction and operation of the program, and instructions on utilization of the many features of the code are presented. Author

N75-32385*# Bell Aerospace Co., Buffalo, N.Y.
COMOC: THREE DIMENSIONAL BOUNDARY REGION VARIANT, THEORETICAL MANUAL AND USER'S GUIDE
A. J. Baker and S. W. Zelazny Washington NASA May 1974 78 p refs
(Contract NAS1-11214)
(NASA-CR-132450; D9192-950002) Avail: NTIS HC $4.75 CSCL 20D

The theoretical and mechanical structure of the computer program is presented along with guidance on adaptation of the code to solution of a particular problem. Sample solutions are discussed for several problems, especially with respect to solution accuracy and speed as a function of parameters under control of the user. Construction of input data decks for sample problems is discussed. Author

N75-32386*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL STUDY OF A FREE TURBULENT SHEAR FLOW AT MACH 19 WITH ELECTRON-BEAM AND CONVENTIONAL PROBES
William P. Harvey and William D. Hunter, Jr. Washington Oct. 1975 72 p refs
(NASA-TN-D-7981; L-10138) Avail: NTIS HC $4.25 CSCL 20D

An experimental study of the initial development region of a hypersonic turbulent free mixing layer was made. Data were obtained at three stations downstream of a M = 19 nozzle over a Reynolds range of 1.3 million to 3.3 million per meter and at a total temperature of about 1670 K. In general, good agreement was obtained between electron-beam and conventional probe measurements of local mean flow parameters. Measurements of fluctuating density indicated that peak root-mean-square (rms) levels are higher in the turbulent free mixing layer than in boundary layers for Mach numbers less than 9. The intensity of rms density fluctuations in the free stream is similar in magnitude to pressure fluctuations in high Mach number flows. Spectrum analyses of the measured fluctuating density through the shear layer indicate significant fluctuation energy at the lower frequencies (0.2 to 5 kHZ) which correspond to large-scale disturbances in the high-velocity region of the shear layer. Author

N75-32387*# Sigma Research, Inc., Richland, Wash.
INVESTIGATION OF AN INVERTED MENISCUS HEAT PIPE WICK CONCEPT
E. W. Saaski Aug. 1975 63 p refs
(NASA Order A-9145-B)
(NASA-CR-137724) Avail: NTIS HC $4.25 CSCL 20M

A wicking concept is described for efficient evaporation of heat pipe working fluids under diverse conditions. It embodies the high heat transfer coefficient of the circumferential groove

while retaining the circumferential fluid transport capability of a thick porous wick or screen. Experimental tests are described which substantiate the efficacy of the evaporation technique for a circumferentially-grooved heat pipe charged alternately with ammonia and R-11 (CCl3F). With ammonia, heat transfer coefficients in the range of 2 to 2.7 W/sq cm K were measured at heat flux densities up to 20 W/sq cm while, with R-11, a heat transfer coefficient of 1.0 W/sq cm K was measured with flux densities up to 5 W/sq cm. Heat transfer coefficients and flux densities were unusually high compared to literature data for other nonboiling evaporative surfaces. Author

N75-32388*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORCED-FLOW ONCE-THROUGH BOILERS
James R. Stone, Vernon H. Gray, and Orlando A. Gutierrez Washington NASA 1975 142 p refs
(NASA-SP-369) Avail: NTIS HC $5.75 CSCL 20D

A compilation and review of NASA-sponsored research on boilers for use in spacecraft electrical power generation systems is presented. Emphasis is on the heat-transfer and fluid-flow problems. In addition to space applications, much of the boiler technology is applicable to terrestrial and marine uses such as vehicular power, electrical power generation, vapor generation, and heating and cooling. Related research areas are discussed such as condensation, cavitation, line and boiler dynamics, the SNAP-8 project (Mercury-Rankine cycle), and conventional terrestrial boilers (either supercritical or gravity-assisted liquid-vapor separation types). The research effort was directed at developing the technology for once-through compact boilers with high heat fluxes to generate dry vapor stably, without utilizing gravity for phase separations. A background section that discusses, tutorially, the complex aspects of the boiling process is presented. Discussions of tests on alkali metals are interspersed with those on water and other fluids on a phenomenological basis. Author

N75-32389*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPARATUS FOR MEASURING A SORBATE DISPERSED IN A FLUID STREAM Patent Application
Otis L. Updike, inventor (to NASA) (Virginia Univ.) Filed 19 Sep. 1975 31 p Sponsored by NASA
(NASA-Case-ARC-10896-1; US-Patent-Appl-SN-615030) Avail: NTIS HC $3.75 CSCL 20D

An apparatus for measuring a sorbate dispersed or dissolved in a fluid stream was constructed. The apparatus is composed of an oscillator for generating an alternating current signal, an acoustic transmission line for disposition in the fluid stream, and an elongated body with a surface capable of sorbing an amount of the sorbate to be measured representative of the concentration in the fluid stream. The body is also capable of propagating acoustic energy along its length from one end portion to another end portion; the propagated acoustic energy is damped in amplitude and shifted in phase so that the change in amplitude or phase is proportional to the amount of sorbate sorbed by the surface. Two transducers and a comparator are also part of the system. One transducer converts ac signals to acoustic energy while the other converts the acoustic energy to an electrical signal at the other end of the body . The comparator compares the electrical signal to the ac signal and develops an output signal corresponding to the difference between the two; the output signal is indicative of the concentration of the sorbate in the fluid system. NASA

N75-32390*# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
WAVE THEORY OF TURBULENCE IN COMPRESSIBLE MEDIA (ACOUSTIC THEORY OF TURBULENCE) Interim Report
Czeslaw P. Kentzer 30 Sep. 1975 118 p
(Grant NGR-15-005-14)
(NASA-CR-119143; Rept-75-2) Avail: NTIS HC $5.25 CSCL 20D

The generation and the transmission of sound in turbulent flows are treated as one of the several aspects of wave propagation in turbulence. Fluid fluctuations are decomposed into orthogonal Fourier components, with five interacting modes of wave propagation: two vorticity modes, one entropy mode, and two acoustic modes. Wave interactions, governed by the inhomogeneous and nonlinear terms of the perturbed Navier-Stokes equations, are modeled by random functions which give the rates of change of wave amplitudes equal to the averaged interaction terms. The statistical framework adopted is a quantum-like formulation in terms of complex distribution functions. The spatial probability distributions are given by the squares of the absolute values of the complex characteristic functions. This formulation results in nonlinear diffusion-type transport equations for the probability densities of the five modes of wave propagation. Author

N75-32391# Foster-Miller Associates, Inc., Waltham, Mass.
ANALYSIS AND CONCEPTUAL DESIGN OF PRACTICAL ICE-WATER HEAT SINKS
Edvard Grande Mar. 1975 163 p refs
(Contract DAAG17-73-C-0238)
(AD-A009498; CRREL-SR-221) Avail: NTIS CSCL 13/1

The study considers the analysis and conceptual design of an ice-water heat sink for use with a 1500 kW nuclear power plant applicable to hardened underground installations. The purpose of the heat sink is to contain the waste heat from the power system during a period in which the installation is completely sealed off from dependence on any surface facilities. An ice-water heat sink system is a very attractive concept due to the large amount of heat associated with the melting of ice. This study is based, to a considerable extent, directly on the results of prior work, and is intended to provide additional information on configuration parameters and system performance to permit development of a practical system design. Two alternative heat sink configurations are recommended for the prototype design: an annular flow heat sink and a top surface melting heat sink. A high level of confidence is placed in the predicted performance of the annular flow configuration. The top surface melting configuration is considered superior in terms of meeting the design objectives, but its predicted performance is based on assumptions that, although reasonable, must be verified by experiments. GRA

N75-32392# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF TEMPERATURE FIELDS AND THERMAL RESISTANCE OF HONEYCOMB LAMINATED CONSTRUCTIONS
Yu. I. Moshnenko 16 Jan. 1975 13 p refs Transl. into ENGLISH from the mono. "I Respublikanskoi Konferentsii po Aerogidromekhanike, Teploobmenu i Massoobmenu, Trudy" USSR, 1969 p 324-320
(AD-A006856; FTD-MT-24-1501-74) Avail: NTIS CSCL 13/3

Honeycomb plastic is a promising thermal insulation material for constructions, where, besides high thermal resistance, a sufficient hardness and strength at a limited weight are required. A study was made of temperature fields and thermal resistance on a steady-state mode of multilayer panels, made in the form of glass-fiber shelves, divided by honeycomb-fiber cells. GRA

N75-32393# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRICAL DISCHARGES IN WATER. A HYDRODYNAMIC DESCRIPTION
K. A. Naugolnykh and N. A. Roii 23 Dec. 1974 212 p refs Transl. into ENGLISH from Mono. Elektr. Razryvady v Vode (USSR), 1971 p 1-155
(AD-A006728; FTD-HC-23-2049-74) Avail: NTIS CSCL 20/4

Contents: Initiation of discharges; properties of the matter in the discharge channel; hydrodynamic problems of the expansion of a cavity in a liquid; theory of the expansion of a discharge channel; hydrodynamic characteristics of discharge--comparison with experiments. GRA

N75-32394# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMIZATION OF THE HEAT-REMOVING RADIATING FIN TAKING INTO ACCOUNT THE ARRIVING ON THEIR SURFACE OF CONVECTIVE AND RADIATION HEAT FLOWS
Yu. G. Zhulev and G. G. Matveev 18 Dec. 1974 23 p refs Transl. into ENGLISH from Tsentr. Aerogidrodinamicheskii Inst.

Uch. Zap. (USSR), v. 1, no. 5, 1970 p 114-117
(AD-A002890; FTD-MT-24-261-75) Avail: NTIS CSCL 20/13

The variational problem of determining the contour shape of heat-transfer radiating fin was investigated. Convective heat transfer and heat sinks are also discussed. M.J.S.

N75-32395# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF A VARIABLE CONDUCTANCE HEAT PIPE M.S. Thesis
Theodore Phillip Naydan Mar. 1975 64 p refs
(AD-A009970) Avail: NTIS CSCL 20/13

A variable conductance, two inch diameter, sixty inch long heat pipe was designed and constructed. The performance characteristics of the heat pipe while operating in both the conventional and variable conductance modes were studied. In particular, the ramifications of using a non-condensible gas which was more than twice as heavy as the working fluid were closely observed with the heat pipe being oriented both horizontally and vertically. Power inputs to the heat pipe were varied from twenty-five to one hundred fifty watts. Methanol was selected for use as the working fluid and krypton was used as the non-condensible gas. Condenser temperature profiles and liquid crystal photographs are presented for the various operating modes. GRA

N75-32396# Naval Postgraduate School, Monterey, Calif.
A STUDY OF UNSTEADY TRANSONIC INTERFERENCE EFFECTS M.S. Thesis
Paul Barron Schlein Mar. 1975 178 p refs
(AD-A009969) Avail: NTIS CSCL 20/4

Nonsteady, interfering, transonic flows are of increasing importance to aeroelasticians. Recent design concepts for transonic transports, high maneuverability fighters, biplanar space shuttle configurations, and so called transonic axial flow compressors, to name a few, involve such flows when aeroelastic problems are considered. It is apparent that the question of the effect of transonic flow, including possible adjacent flow field interference, on flutter must be confronted in a practical way. GRA

N75-32397# California State Univ., Long Beach. Dept. of Mechanical Engineering.
AN INVERSE BOUNDARY-LAYER METHOD FOR COMPRESSIBLE LAMINAR AND TURBULENT FLOWS Final Report, 1 Jan. 1974 - 1 Jan. 1975
Tuncer Cebeci 8 Apr. 1975 50 p refs
(Contract N00014-74-A-0203-0001; NR Proj. 215-234)
(AD-A010270; TR-75-1) Avail: NTIS CSCL 20/4

This report presents an efficient method for calculating laminar and turbulent boundary-layer flows for standard and inverse boundary-value problems. It is applicable to both incompressible and compressible flows. The standard boundary-layer problem considers the solution of the usual boundary-layer equations for a given external velocity distribution. The inverse problem considers the solution of the governing equations for assigned wall shear or assigned displacement thickness. GRA

N75-32398# Naval Surface Weapons Center, White Oak, Md.
WATER WAVES: ANALYTIC SOLUTIONS, UNIQUENESS AND CONTINUOUS DEPENDENCE ON THE DATA
Joel C. W. Rogers 18 Apr. 1975 178 p refs
(AD-A010525; NSWC/WOL/TR-75-43) Avail: NTIS CSCL 20/4

This report contains the results of some preliminary work on the water wave problem. The questions of local existence in time of analytic solutions and uniqueness and continuous dependence on the initial data are treated. The object of the work is to provide the analytical foundation on which numerical solutions of the water wave problem can be constructed. GRA

N75-32399# Institute for Defense Analyses, Arlington, Va.
LATE STAGE OF RAYLEIGH-TAYLOR INSTABILITY
David H. Sharp and John A. Wheeler Aug. 1961 53 p refs
Prepared in cooperation with Bowdoin Coll., Brunswick, Maine
(AD-A009943; IDA/HQ-63-1426) Avail: NTIS CSCL 20/4

When a nearly flat fluid surface is subject to a small sinusoidal disturbance and a gravity or other acceleration field acts on the fluid so as to destabilize the surface, the irregularities grow exponentially with time in the regime of small amplitudes where linear theory applies (Rayleigh). At larger amplitudes linear theory ceases to apply and the gas or magnetic field at the interface penetrates linearly with time into the fluid in the form of fingers or bubbles (G.I. Taylor). The subsequent stage of successive mergers between fingers to make larger and faster ones is considered. To the extent that a statistical analysis is valid it is suggested that a free slab of fluid cannot be accelerated to more than about 50 times its won thickness without suffering breakthrough. GRA

N75-32400# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE TRANSITION POINT OF A LAMINAR BOUNDARY LAYER TO A TURBULENT BOUNDARY LAYER FROM THE DISTRIBUTION OF A VOLTAGE DROP
A. S. Mozolkov 19 Dec. 1974 17 p refs Transl. into ENGLISH from Uch. Zap. Tsentr. Aerogidrodinamicheskii Inst. (USSR), v. 3, no. 2, 1972 p 147-149
(AD-A003082; FTD-MT-24-276-75) Avail: NTIS CSCL 20/4

The report describes a hot wire measurement procedure of the position of the transition point of a laminar boundary layer to a turbulent one. GRA

N75-32401# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONDITIONS FOR EXISTENCE OF THE INVARIANT SOLUTIONS TO THE EQUATIONS OF THREE-DIMENSIONAL LAMINAR BOUNDARY LAYER ON DEVELOPABLE SURFACES
V. S. Kaplan 27 Mar. 1975 27 p refs Transl. into ENGLISH from Uch. Zap. Tsentr. Aerogidrodinamicheskii Inst. (USSR), v. 3, no. 3, 1972 p 36-44
(AD-A010408; FTD-MT-24-0326-75) Avail: NTIS CSCL 20/4

All of the distributions of pressure on the fairing were found, with which the equations of a three dimensional laminar boundary layer in noncompressible liquid assumed a decrease of independent variables. The basic group of transformations for each of these distributions was established, which made it possible to find the invariant solutions of the rank of two equations of the boundary layer. Author (GRA)

N75-32402# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
LASER DOPPLER VELOCIMETER MEASUREMENTS IN HIGH SPEED FLOWS Final Report, 26 Aug. 1971 - 30 Jun. 1974
H. Doyle Thompson, Warren H. Stevenson, Ronald D. Flack, and Ronald E. Zammit 31 Dec. 1974 93 p refs
(Contract DAAH01-72-C-0089; DA Proj. 1M2-62303-A-214)
(AD-A010401; RD-CR-75-2) Avail: NTIS CSCL 20/4

A three year research program covering the development and use of a Laser Doppler Velocimeter (LDV) for high speed flow measurements is described. The current configurations of the LDV optics and the high frequency signal processors are discussed. LDV measurements made in two-dimensional transonic nozzles and in the turbulent wake of an axisymmetric supersonic nozzle are presented. These are compared with previous experimental and analytical results. Excellent agreement is found to exist. Measurement problems presented by flows of extremely high turbulence intensity are illustrated and means for resolving them are discussed. GRA

N75-32403# Naval Postgraduate School, Monterey, Calif.
FUEL CELL ENTRY WALL RESPONSE TO HYDRAULIC RAM M.S. Thesis
Bruce Dean Page Mar. 1975 59 p refs
(AD-A009988) Avail: NTIS CSCL 19/4

Hydraulic ram concerns the dynamic loads and catastrophic failure of liquid-filled fuel tanks impacted by high speed projectiles. Hydraulic ram is divided into two phases: the shock phase and the drag phase. Analytical models have been proposed for the shock phase pressures by Yurkovich and for the drag phase pressures by Lundstrom. Comparisons were made between hydraulic ram fuel cell entry wall strains predicted using several loading models and those determined experimentally. A reasonable correlation was achieved but more work must be done to

permit predictions of hydraulic ram strains accurate enough for the purpose of fuel cell design. GRA

N75-32404# Indiana Univ., Bloomington. Dept. of Mathematics.
THE INVERSE STEFAN PROBLEM FOR THE HEAT EQUATION IN TWO SPACE VARIABLES
David Colton 1974 12 p refs
(Grant AF-AFOSR-2592-74)
(AD-A006823; AFOSR-75-0336TR) Avail: NTIS CSCL 20/13

In this paper the author outlines an inverse method for constructing analytic solutions to the (single phase) Stefan problem for the heat equation in two space dimensions. GRA

N75-32405# Technische Hochschule, Aachen (West Germany). Inst. fuer Allgemeine Mechanik.
THE STABILITY OF LAMINAR BOUNDARY LAYER AT LONGITUDINALLY CURVED WALLS WITH RESPECT TO TRANSVERSE PERTURBATIONS Final Technical Report
Fritz Schultz-Grunow and Dj. Behbahani 30 Dec. 1974 26 p refs
(Grant DA-ERO-591-74-G0018)
(AD-A006579; ARDG(E)-R/D-2038) Avail: NTIS CSCL 20/4

The investigation is based upon second order boundary layer theory along longitudinally and concave curved walls. It also covers boundary control with suction since both these cases are mathematically identical. The stability is proved with respect to perturbations which have the shape of longitudinal vortices with constant spacing. The neutral curve is calculated. The perturbations are introduced into the complete Navier-Stokes equations and then are linearized. Full account is also taken of the geometric influence of curvature. The asymptotic solution is derived analytically. Near the wall a numerical solution is derived by applying the Runge-Kutta method. Both solutions are fitted to derivatives which occur in the differential equations. Thus a complete fit of the two solutions is attained. The neutral curves are presented in a diagram for different curvature parameters for walls with leading edge and with the shape of the evolute of a circle. GRA

N75-32406# Harry Diamond Labs., Adelphi, Md.
NUMERICAL STUDY OF STEADY FLOW IN A TWO-DIMENSIONAL RECTANGULAR CHANNEL WITH AN ASYMMETRIC VELOCITY INPUT PROFILE
Paul G. Hershall Dec. 1974 69 p refs
(DA Proj. 1T0-61102-B-14A)
(AD-A010355; HDL-TR-1668) Avail: NTIS CSCL 20/4

The two-dimensional, viscous, incompressible, steady flow in a semi-infinite rectangular channel is investigated numerically. A given jet with asymmetrical velocity profile is assumed at the inlet and fully developed flow is assumed at an infinite distance downstream. Using the split Navier-Stokes equation, with stream function and vorticity as dependent variables, central differences are used to set up difference equations. These are relaxed in the Gauss-Seidel mode with the aid of two relaxation factors for each equation and a maximum-number-of-iterations parameter for each equation. The optimum convergence rate is investigated empirically as a function of these six parameters. Convergence is obtained in this way up to Reynolds number 200 and optimum sets of values are given for (R sub e) = 1, 10, 50, and 200. GRA

N75-32407# Martin Marietta Aerospace, Denver, Colo.
STUDY OF WALL JETS IN DUCT DIFFUSER SYSTEMS Final Technical Report, Apr. - Sep. 1974
Wendel J. Maegley and James M. Lefferdo Feb. 1975 70 p refs
(Contract F33615-74-C-1117)
(AD-A010102; MCR-74-366; ARL-75-0010) Avail: NTIS CSCL 20/4

The effectiveness of wall jets in preventing diffuser stall in a simulated two-dimensional thrust augmenter was experimentally investigated. The tests were conducted in the static mode; that is, the flow through the inlet of the model was free from ram-air effects. The velocity of the airflow through the model ranged from 90 to 260 ft/s while the area ratio of the diffuser was systematically varied from 1.73 to 2.72. The wall-jet slot height was varied from 0.05 to 0.196 in. Nitrogen wall jets were found to be an effective means of suppressing stall. For a given diffuser area ratio and wall-jet slot height, the minimum wall-jet mass flow was an almost constant fraction of the primary air mass flow. From the standpoint of power required to suppress stall, larger jets were more efficient. GRA

N75-32408# Abcor, Inc., Cambridge, Mass. Walden Research Div.
PROCEDURES FOR MEASUREMENT IN STRATIFIED GASES, VOLUME 1 Final Report, Jun. 1973 - May 1974
A. Zakak, R. Siegel, J. McCoy, S. Arab-Ismali, and J. Porter Sep. 1974 277 p refs
(Contract EPA-68-02-1306)
(PB-241837/4; EPA-650/2-74-086-A-Vol-1) Avail: NTIS HC $8.75; HC also available from NTIS $15.00/set of 2 reports as PB-241836-SET CSCL 07D

Results are given of a program to develop methods for the continuous extraction of representative gas samples from gas streams that exhibit compositional stratification, such as in a stack or chimney. Available data in the literature are considered as well as field data. Wind tunnel tests and mathematical modeling are used to develop sampling methodologies which are recommended. Results from the literature and field surveys indicate that gas stratification exists, but it is likely to be less general and less severe than particulate stratification. For a given gas stream, it is necessary to make a preliminary gas concentration survey to determine the existence of spatial stratification. Methods for obtaining representative gas samples are recommended. The use of devices to mix stratified gas streams is examined. GRA

N75-32409# Abcor, Inc., Cambridge, Mass. Walden Research Div.
PROCEDURES FOR MEASUREMENT IN STRATIFIED GASES. VOLUME 2: APPENDICES Final Report, Jun. 1973 - May 1974
A. Zakak, R. Siegel, J. McCoy, S. Arab-Ismali, and J. Porter Sep. 1974 214 p refs
(Contract EPA-68-01-1306)
(PB-241838/2; EPA-650/2-74-086-b-Vol-2-App) Avail: NTIS HC $7.25; HC also available from NTIS $15.00/set of 2 reports as PB-241836-SET CSCL 07D

For abstract, see N75-32408.

N75-32410# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLOW OF SUPERSONIC FLOW ABOUT THE SPHERICAL SURFACE OF THE EQUALLY DISSOCIATING AIR
A. P. Kosykh and A. N. Minailos 31 Jan. 1975 32 p refs Transl. into ENGLISH from Tsentr. Aerogidrodinamicheskii Inst. Uch. Zap. (USSR), v. 2, no. 5, 1971 p 9-16
(AD-A007228; FTD-MT-24-0303-75) Avail: NTIS CSCL 20/4

Solutions were obtained to the problem of hypersonic flow about the spherical surface of air in the infinity range for both height and velocity. An explicit finite difference diagram was used to numerically accomplish the objective. Comparisons were made of results obtained by different numerical and analysis methods. Author (GRA)

N75-32411# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNSTEADY PROBLEM OF THE SUDDEN MOTION OF WEDGE AND CONE AT SUB- AND SUPERSONIC SPEEDS
R. Ya. Tugazakov 4 Feb. 1975 28 p refs Transl. into ENGLISH from Tsentr. Aerogidrodinamicheskii Inst. Uch. Zap. (USSR), v. 4, no. 1, 1973 p 1-9
(AD-A007236; FTD-MT-24-0493-75) Avail: NTIS CSCL 20/4

The aerodynamic characteristics of wings and conical bodies at sub- and supersonic speeds are determined. Factors considered include: sudden motions, constant velocity flow, and wing pressure distribution. J.M.S.

N75-32412# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL STUDY OF HEAT TRANSFER ON FLAT PLATE DURING THE INTERACTION OF OBLIQUE SHOCK WAVE WITH LAMINAR BOUNDARY LAYER
I. A. Kondratev 8 Jan. 1975 21 p refs Transl. into ENGLISH

from Tsentralnyi Aerogidrodinamicheskii Inst. Uchenye Zapiski (USSR), v. 2, no. 2, 1971 p 18-23
(AD-A007178; FTD-MT-24-268-75) Avail: NTIS CSCL 20/4

Flat plates with two and three dimensional interactions of oblique shock waves with the boundary layer were studied. The correlation of the maximum values of heat flux in the range of the boundary layer connection was found. M.J.S.

N75-32413# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FLOW OF THE VISCOUS GAS BETWEEN TWO DRIVING PARALLEL PLATES

E. M. Zhmulin 5 Feb. 1975 16 p refs Transl. into ENGLISH from Tsentralnyi Aerogidrodinamicheskii Inst. Uchenye Zapiski (USSR), v. 2, no. 4, 1971 p 31-37
(AD-A007233; FTD-MT-24-0461-75) Avail: NTIS CSCL 20/4

The compressibility effect on the velocity distribution and temperature in flow and on the value of tangential stress on the channel wall was investigated. Solutions to the problem of the steady Couette flow for a viscous gas were found by introducing generalized variables for velocity and a coordinate perpendicular to the velocity vector. M.J.S.

N75-32414# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DIFFERENCE DIAGRAMS OF THE INCREASED ACCURACY FOR THE NUMERICAL SOLUTION OF SOME PROBLEMS OF AERODYNAMICS

A. I. Tolstykh 7 Feb. 1975 37 p refs Transl. into ENGLISH from Tsentralnyi Aerogidrodinamicheskii Inst. Uchenye Zapiski (USSR), v. 4, no. 2, 1973 p 36-44
(AD-A007235; FTD-MT-24-0482-75) Avail: NTIS CSCL 20/4

A method is described for the construction of implicit conservative difference diagrams suitable for calculating inviscid and viscous gas flows. Shock waves and questions of stability are discussed. M.J.S.

N75-32415# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INVESTIGATION OF SHOCK-WAVE PROPERTIES AND DEPOLARIZATION OF PZT-19 PIEZOCERAMICS

E. Z. Novitskii, E. S. Tyunkin, V. N. Mineev, and O. A. Kleshchevnikov 25 Oct. 1974 16 p refs Transl. into ENGLISH from Mono. Gorenie i Vzryv (Moscow), 1972 p 602-607
(AD-A001190; FTD-MT-24-1997-74) Avail: NTIS CSCL 11/2

The behavior of piezoceramic materials in shock waves is examined. Results are presented and discussed. J.M.S.

N75-32416# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE THERMODYNAMIC ACCELERATION OF TWO-PHASE LAMINAR FLOWS IN CHANNELS WITH PENETRABLE WALLS

A. F. Kolesnichenko and K. I. Kim 25 Oct. 1974 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavendenii, Energ. (Minsk), no. 5, 1972 p 78-84
(FTD Proj. T74-04-03)
(AD-A001194; FTD-MT-24-2248-74) Avail: NTIS CSCL 20/4

An electro- conductive liquid (liquid metal) is discussed which acquires kinetic energy because of the work of expansion of a gas. In power plants which utilize this principle, friction within the liquid metal pistons substantially reduces plant efficiency, and causes breakdowns. Piston velocities were calculated, and a method is presented to eliminate friction by the use of accelerating channels of gas permeable walls which can be made from porous materials. Results indicate that by blowing in gas through the porous channel walls, friction is sharply reduced (by the gas pushing against the liquid metal), and efficiency is improved by at least 90 percent. J.R.T.

N75-32417# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

SIMPLIFICATIONS OF THE BOUNDARY CONDITION AT A SLOTTED WIND-TUNNEL WALL WITH A BOUNDARY LAYER

Peje Loefgren Mar. 1975 47 p refs
(Grant AF-AFOSR-2184-72; AF Proj. 9781)
(AD-A010504; FFA-AU-932; SR-1; AFOSR-75-0712TR) Avail: NTIS CSCL 20/4

Starting from a strongly idealized physical model of subsonic flow past slender axisymmetric bodies in a longitudinally slotted wind tunnel of circular cross-section a homogeneous boundary condition is derived, which is to be used at the tunnel wall in connection with the usual potential equation for non-viscous flow in order to produce approximately the same flow field in the central part of the tunnel as the field resulting from taking into consideration the complicated viscous flow at the slotted wall. GRA

N75-32418# Los Alamos Scientific Lab., N.Mex.

SOLA: A NUMERICAL SOLUTION ALGORITHM FOR TRANSIENT FLUID FLOWS

C. W. Hirt, B. D. Nichols, and N. C. Romero Jan. 1975 53 p (Contracts NAonr-6-75; W-7405-ENG-36; NR Proj. 062-455)
(AD-A009953; LA-5852) Avail: NTIS CSCL 20/4

A finite difference technique is presented for solving the Navier-Stokes equations for an incompressible fluid. The technique, based on the Marker-and-Cell method, is simplified to facilitate its use by persons with little or no experience in numerical fluid dynamics. Section I of the report describes the basic algorithm, SOLA, for confined flows; Sec. II describes modifications necessary for free or curved rigid surface boundaries. Each includes a flow chart and a FORTRAN listing. Sample problems show how to incorporate simple modifications into the basic code to adapt it to a variety of problems. GRA

N75-32419# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOLUTION OF THE PROBLEMS OF POISEUILLE FLOW AND TEMPERATURE CREEP IN FLAT DUCT WITH THE ARBITRARY VALUE OF KNUDSEN NUMBER

N. K. Makashev 18 Dec. 1974 15 p refs Transl. into ENGLISH from Tsentr. Aerogidrodinamicheskii Inst. Uch. Zap. (USSR), v. 1, no. 5, 1970 p 98-100
(AD-A002893; FTD-MT-24-260-75) Avail: NTIS CSCL 20/4

Numerical solutions were obtained for model kinetic equations used to solve the problem of rarefied gas flow in a flat duct. Results are compared with approximate analytical solutions. M.J.S.

N75-32420# Purdue Univ., Lafayette, Ind. SQUID Headquarters.

A NOTE ON FAVRE AVERAGING IN VARIABLE DENSITY FLOWS

R. W. Bilger May 1975 13 p refs Prepared in cooperation with Calif. Univ., San Diego
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-A010226; SQUID-TR-UCSD-6-PU) Avail: NTIS CSCL 20/4

The concept of a Favre probability density function is introduced and this formalizes the definition of Favre averages in variable density flows. Current approaches to turbulence modeling suggest that it is the Favre probability density function which models in such flows. This is of particular use in the modeling of conserved scalars since the conservation equations deliver the Favre average and variance. GRA

N75-32526 Joint Publications Research Service, Arlington, Va.

A SEMIEMPIRICAL METHOD OF DESCRIBING THE MECHANISM OF VERTICAL TURBULENT MIXING

O. V. Kazakov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 76-84 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 61-67 (For availability see N75-32517 23-42)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N75-32421 Pennsylvania State Univ., University Park.
THE MAGNETIC SECTOR ATOM-PROBE FIM AND ITS APPLICATIONS Ph.D. Thesis
Toshio Sakurai 1974 129 p
Avail: Univ. Microfilms Order No. 75-19808

A magnetic sector atom-probe FIM (magnetic atom-probe) which is a combination of an FIM providing the atomically resolved image of the specimen and a mass spectrometer of single particle detection capability was constructed and successfully operated for studies of energy distribution of field ionization and field evaporation. The features of this instrument are: a Chevron microchannel plate employed as the ion detector displays a good portion of the entire momentum spectrum simultaneously with the resolution of better than 1/1000 and single ion sensitivity; by a simple manipulator any desired surface site of the specimen tip can be positioned toward the probe hole which is connected to the mass spectrometer. Using the energy distribution of the free-space field ionization accessible by this system, a method of field calibration was developed which is a much needed factor in analyses of FIM experiments. Reliable data of evaporation fields of various materials, such as W, Mo, Rh, Ir, Pt and Ni, were obtained. The performance of our magnetic atom-probe was tested by field evaporation experiments. Dissert. Abstr.

N75-32422 California Inst. of Tech., Pasadena.
THE MODULATED GRATING HOLOGRAM Ph.D. Thesis
David Rodgers MacQuigg 1975 214 p
Avail: Univ. Microfilms Order No. 75-20001

A phase and amplitude, off-axis hologram was synthesized from three computer-generated transmission masks, using a multiple-exposure holographic recording method. Each of the masks controls one fixed-phase component of the complex hologram transmittance. The basic grating is generated optically, relieving the computer of the burden of drawing details the size of each fringe. The maximum information capacity of the computer plotting device can then be applied to the generation of the grating modulation function. By this method, large digital holograms (25 mm by 25 mm) were synthesized in dichromated gelatin. The recording method is applicable to virtually any holographic medium. The modulated grating hologram was designed primarily for the application of spatial filtering, in which the requirement is a hologram with large dynamic range and large free spectral range. Dissert. Abstr.

N75-32423 Missouri Univ., Columbia.
COLOR MEASUREMENTS AND IMAGE DISCRIMINATION ON MULTIEMULSION FILMS Ph.D. Thesis
Jack Harold Hansen 1974 106 p
Avail: Univ. Microfilms Order No. 75-20117

Using digitized transmittance measurements made with a microspectrophotometer combined with multivariate discriminant analysis methods, a species of Missouri hardwoods were discriminated from each other and from their naturally occurring backgrounds. A short-cut technique which proved highly accurate was developed to obtain the color metrics of images in terms of internationally accepted CIE (Commission Internationale de l'Eclairage) systems. Tests were run on the effect of various preprocessing transformations on correctly discriminating between image groups. The tests were performed on two different data sets, one of natural vegetation images and their associated backgrounds and the other of images of closely matching Munsell color chips. Of the two-ranked preprocessing transformations examined, only the 1960 CIE-UCS system is shown to be accurate and recommended in situations where it is important to negate scene brightness. A study of color target images revealed that there was a flight altitude associated color shift toward the blue portion of the spectrum. Dissert. Abstr.

N75-32424 Ohio State Univ., Columbus.
A STUDY OF A HOLOGRAPHIC ANALOG ASSOCIATIVE MEMORY WITH APPLICATION TO PATTERN RECOGNITION Ph.D. Thesis
Mohammad-Taghi Fatehi 1975 244 p
Avail: Univ. Microfilms Order No. 75-19434

A holographic associative memory for classification of analog data is proposed and developed. The device is characterized by high information storage density and distributive memory associated with holography, and parallel processing and instantaneous information retrieval associated with optical computing systems. Use of astigmatic optical system and complement coded interrogation format make the system unique. The problem of coding the data on the page composer is studied. The theorems found show that the aperture position coding permits maximum information storage consistent with the analog associative property. The application of the system in recognition of three dimensional objects by the method of moment invariants is considered. A system architecture is presented using this memory for classification of multidimensional feature vectors by the nearest neighbor rule. Dissert. Abstr.

N75-32425 Suomalainen Tiedeakatemia, Helsinki (Finland).
THE DOUBLE BEAM CHOPPING PHOTOMETER-POLARIMETER
Vilppu Piirola (Helsinki Univ.) 1975 64 p refs
(ISBN-951-41-0240-1) Copyright. Avail: Issuing Activity

A photoelectric instrument for both photometric and polarimetric observations of astronomical objects was constructed and tested. The use of synchronous integration and chopping techniques to accomplish a dual channel measurement by a single photomultiplier yields an effective way of reducing systematic instrumental errors and difficulties in calibration. In photometry the two channels are used for synchronous measurement of star and background, which makes it possible to compensate for the effects of a high and variable background radiation and thus considerably increase the number of useful observing nights. In polarimetry a plane parallel calcite plate is used to produce two prependicularly polarized images of a star in the focal plane of the telescope. The intensities of the two images are measured by the chopping technique coupled with synchronous integration. The most important advantages of the polarimeter are: simplicity, fully achromatic square wave modulation, and direct elimination of position angle and time dependent instrumental errors. Also sky background polarization is directly eliminated. Author

N75-32426*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METALLIC HOT WIRE ANEMOMETER AND METHOD FOR FABRICATING THE SAME Patent Application
Fred R. Lemos, inventor (to NASA) Filed 5 Sep. 1975 13 p
(NASA-Case-ARC-10911-1; US-Patent-Appl-SN-610802) Avail: NTIS HC $3.25 CSCL 14B

A hot wire anemometer is described which has a body formed of heat resistant metal such as an alloy very high in nickel content. The body supports a probe wire in a moving air stream and is mechanically arranged so that the probe wire is disposed in a V groove in the body; the V groove contains a high temperature ceramic adhesive that partially encompasses the downstream side of the probe wire. Mechanical and electrical connection to the probe wire is achieved through conductive support rods which were constructed of the same high temperature metal, insulation between the body and the conductor rods being provided by an oxide coating. The oxide coating insulates the conductor rods from the body, mechanically fixes the conductors within the body, and maintains its integrity at elevated temperatures to which a hot wire anemometer is typically subjected. A method for forming the anemometer structure is included which employs conventional machining procedures combined in a novel sequence. NASA

N75-32427*# Nebraska Univ., Lincoln. Behlen Lab. of Physics and Astronomy.
TRANSFER CALIBRATION OF THE TRANSMISSION OF ELECTRON-ENERGY SPECTROMETERS
J. L. Gardner and James A. R. Samson [1975] 12 p refs
(Grant NGR-28-004-21)
(NASA-CR-119135) Avail: NTIS HC $3.25 CSCL 14B

Relative intensities of strong peaks in the HeI photoelectron spectra of N2, CO2, CO, and O2 are tabulated. These data were measured with an electron energy analyzer ,whose relative transmission was calibrated to an accuracy of + or - 5%. The tables are useful for calibrating the transmission of other analyzers for electron energies below 9 eV. Correction for angular distribution effects is discussed. Author

N75-32428*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
MULTIFREQUENCY MICROWAVE RADIOMETER (MFMR) L-BAND MODIFICATION
S. C. Reid Mar. 1973 48 p refs
(Contract NAS9-12200)
(NASA-CR-144461; LEC-0336; JSC-09876) Avail: NTIS HC $3.75 CSCL 14B

The redesign of the L-band part of the multifrequency microwave radiometer (MFMR) was conducted to provide an instrument with improved sensitivity and accuracy. The results are discussed. Author

N75-32429*# Honeywell Radiation Center, Lexington, Mass.
S192 MULTISPECTRAL SCANNER CHANNEL 13 ELECTROMECHANICAL NOISE INVESTIGATION ECP-166
H. Koumjian [1975] 95 p
(Contract NAS9-11196)
(NASA-CR-144468) Avail: NTIS HC $4.75 CSCL 14B

A review is presented of all data on the multispectral scanner having to do with low frequency noise. The noise is component-induced, either mechanical or electrical or a combination of both. To assist in understanding the source of the noise, several dynamic analyses both structural and electrical were made and are reported. A review is presented of structural resonance test data obtained with the use of an accelerometer and strain gage sensors. Results of an analysis of the natural frequencies of the Dewar leads is included along with an analysis of the S192 cooler and its supporting structure. Other topics discussed include electronic stability of the forward signal, automatic gain control, and the offset control feedback loops as well as the preamplifier which utilized on integrator feedback circuit. Author

N75-32430*# Technicolor Graphic Services, Inc., Houston, Tex.
FLIGHT TEST COMPARISON OF FILM TYPE SO-289 AND FILM TYPE 2424 IN THE AMPS CAMERA
Lincoln Perry Sep. 1975 10 p
(Contract NAS9-11500)
(NASA-CR-144465) Avail: NTIS HC $3.25 CSCL 14E

A flight test was conducted to determine the suitability of SO-289 multispectral infrared aerial film for Earth Resources' use. It was directly compared to film type 2424, infrared aerographic film, the IR film in current use. The exposure parameters for both films are given. Author

N75-32431# Missouri State Highway Dept., Jefferson City. Div. of Materials and Research.
FIELD EVALUATION OF A DIRECT TRANSMISSION TYPE NUCLEAR MOISTURE-DENSITY GAUGE
Jan. 1975 24 p refs
(PB-241440/7) Avail: NTIS HC $3.25 CSCL 14B

Results obtained by a nuclear moisture-density gauge were correlated to those obtained by a balloon type volume device and oven drying. The nuclear testing modes were direct transmission for wet density and backscatter for moisture. Comparison tests were made on active construction projects in each of 10 soil types and graded aggregate bases from 10 stone formations. The test results were analyzed statistically by regression, correlation coefficient, and t test (compression of the means). It was found that the manufacturer's wet density calibration curve provided acceptable results in all of the Missouri soil types and stone formations tested but that the manufacturer's water calibration curve frequently furnished unacceptable values for moisture content. Acceptable moisture content values were obtained with the nuclear gauge by use of a computed correction factor. GRA

N75-32432# Naval Ordnance Lab., White Oak, Md.
QUANTITATIVE APPLICATIONS OF HOLOGRAPHIC INTERFEROMETRY TO WIND-TUNNEL TESTING
Tse-Fou Zien, William C. Ragsdale, and W. Charles Spring, III 31 Dec. 1974 102 p refs
(AD-A009753; NOLTR-74-96) Avail: NTIS CSCL 14/2

Holographic interferometry was successfully applied to a large-scale wind tunnel (40-cm x 40-cm test section) experiment on a three-dimensional flow field. The laser interferometer was set up in a schlieren bench with a pulsed-ruby laser as the light source. Both the object beam and the reference beam were collimated. The conventional double-exposure, off-axis operation was used to produce interferograms. A 15-degree half-angle opaque cone at zero and 16.5 degrees yaw in a M = 2 free stream provided the flow field for the investigation. The aerodynamic conditions were such that flow field was largely inviscid. A rational procedure of general applicability was developed which makes the proper use of an efficient data-reduction theory to calculate the three-dimensional density fields around opaque bodies. Author (GRA)

N75-32433# Cramer (H.E.) Co., Inc., Salt Lake City, Utah.
EVALUATION OF THE CHEMICAL LABORATORY TNO CIRCULAR SLIDE RULE FOR HAZARD CALCULATIONS Final Technical Report
R. K. Dumbauld Apr. 1975 40 p refs
(Contract DAAD09-74-C-0005)
(AD-A009751; DPG-TR-75-310) Avail: NTIS CSCL 14/2

The Chemical Laboratory TNO of the Netherlands has developed a circular slide rule for estimating hazard distances downwind from ground-level point and line sources. The purpose of the work described in this technical report is to evaluate the effectiveness of the slide rule in calculating hazard distances and to compare hazard distances obtained from the slide rule with those calculated from models currently used by the U.S. Army. The study shows that the Chemical Laboratory TNO slide rule provides a convenient and effective means for the field personnel, relatively unskilled in dispersion calculations, to estimate hazard distances. Hazard distances obtained using the TNO slide rule are generally in good agreement with those calculated from DPG models. Some minor changes are suggested in the slide rule scales for neutral meteorological conditions and in the procedures for determining stability classifications. GRA

N75-32434# Ballistic Research Labs., Aberdeen Proving Ground, Md.
IMAGE INFORMATION BY MEANS OF SPECKLE PATTERN PROCESSING
Paul H. Deitz Mar. 1975 26 p refs
(AD-A009724; BRL-1772) Avail: NTIS CSCL 20/6

When a laser beam is reflected from a diffuse surface, a granular scattering distribution is commonly observed, called a speckle pattern. The author discusses some of its ramifications: (1) that this pattern is the time-dependent analogue of the signal used in the classic Hanbury Brown - Twiss stellar interferometer of the 1950's; (2) that this pattern can be processed by standard incoherent optical techniques to yield information pertaining to the object radiance distribution; (3) that this same signal, when processed by coherent-optical techniques, is equivalent to the Gabor on-axis hologram or the Fourier-transform hologram, depending on the specific source configuration; and (4) that signals processed by all of the above techniques are comparatively insensitive to atmospheric turbulence. An experiment is performed to illustrate the procedure of item (2) and then modified to show assertion (4). GRA

N75-32435# Singer Co., Little Falls, N.J. Kearfott Div.
MICROGRADIENT CESIUM MAGNETOMETER DEVELOPMENT Technical Report, Dec. 1973 - Oct. 1974
James H. Simpson, Donald S. Bayley, and Lincoln Ferriss Nov. 1974 42 p refs
(Contract N00014-72-C-0087; NR Proj. 220-039)
(AD-A006596; KD-74-50) Avail: NTIS CSCL 17/8

A series of preliminary tests have been performed with the laboratory demonstration model of the optically-pumped cesium microgradient magnetometer. Additional tests were conducted in earth's magnetic field at an outdoors site which was isolated from large scale magnetic disturbances. The smallest change in differential magnetic field between the two sensors was 19 nanogauss. Since the separation of the sensors is 1.5 feet, the threshold gradient is 13 nanogauss/foot. This threshold was

most likely determined by the electronic test equipment which was between 12 and 15 feet from the sensor. The magnetic field gradients from this equipment also limited the transverse relaxation time of the cesium resonance to about 5 msec. The signal-to-noise ratio at the outputs of the self oscillating cesium magnetic resonance circuits was 85 dB. The theoretical sensitivity for these values of signal-to-noise and relaxation time is 5 nanogauss which at the 1.5 foot spacing corresponds to a gradient of 3.3 nanogauss/foot. Test operation in an improved magnetic environment with the test equipment further from the sensor should demonstrate a threshold approaching the goal of 1 nanogauss/foot. GRA

N75-32436# C and C Research, Inc., Danvers, Mass.
CPA COLOR NEGATIVE STUDY (CONCURRENT PHOTON APPLICATION) Final Report, Nov. 1973 - Dec. 1974
M. R. Cole, R. A. Daunais, and J. R. Boyd Apr. 1975 38 p refs
(Contract F30602-74-C-0040; AF Proj. 5534)
(AD-A010006; RADC-TR-75-87) Avail: NTIS CSCL 14/5

The basic Concurrent Photon Amplification (CPA) technique has been modified and optimized for two Kodak color negative films: Kodak Kodacolor-II and Kodak 2445. Speed increases of up to 8 times (3 stops) have been achieved with good color balance and good print contrast. A CPA capability for Kodacolor-II and a range of black and white films from Kodak Pan-X to Kodak Tri-X was installed into two Pentax Spotmatic II, 35mm cameras. Power and controls for the CPA circuits are contained in a detachable case which fastens neatly underneath the camera bottom without obstructing any of the camera functions and provides a single lever activator of the CPA lamps and release of the camera shutter. GRA

N75-32437# Northeastern Univ., Boston, Mass. Electronics Research Lab.
SINGLE RANGE SIX DECADE FREQUENCY METER AND LOGIC PROBE
Norman C. Poirier 7 Apr. 1975 19 p refs
(Contract F19628-73-C-0148; AF Proj. 7659)
(AD-A010458; SR-3; AFCRL-TR-75-0232) Avail: NTIS CSCL 14/2

The report describes a unique approach to the monitoring of frequency in the range of 1 Hz to 1 MHz using digital processing and a single range analog meter. The circuit to perform this task is simple, inexpensive and compact. GRA

N75-32438# Range Commanders Council, White Sands Missile Range, N.Mex. Telecommunications Group.
HIGH-SPEED CAMERA TIMING REPORT Final Report
Nov. 1973 105 p refs
(AD-A010276) Avail: NTIS CSCL 14/5

The technical report contains the results of tests conducted on Light Emitting Diodes (LEDS) for use as replacements for neon lamps. Neon lamps have been used to imprint data on the continuous running photographic films used in various types of instrumentation camera systems. All test results indicate that LEDS produce superior timing marks, improve field operation, reduce maintenance costs, and significantly increase timing reliability. Included in the appendices to this report are purchase descriptions of new Timing Terminal Units (TTU) and related equipment. GRA

N75-32439# Transportation Systems Center, Cambridge, Mass.
AUTOMATIC EXTRACTION OF HIGHWAY TRAFFIC DATA FROM AERIAL PHOTOGRAPHS Final Report, Jul. 1970 - Jun. 1974
Juris G. Raudseps Apr. 1975 78 p refs
(PB-242002/4; DOT-TSC-FHWA-75-1) Avail: NTIS HC $4.75 CSCL 09B

The design of a system for scanning sequences of aerial photographs with a computer-controlled flying-spot scanner and automatically measuring vehicle locations is described. Hardware and software requirements for an operational system of this type are enumerated. Measurement accuracy is predicted to be comparable to that achieved with manual methods in high-volume applications. The cost of such a system is estimated to exceed $500,000. Efficient operation is shown to be critically dependent on the development of an algorithm for predicting vehicle positions that is significantly better than that now available. GRA

N75-32440# TRW Systems Group, Redondo Beach, Calif.
DEVELOPMENT OF A ZERO-G GAUGING SYSTEM, VOLUME 1 Final Report, Oct. 1973 - Jun. 1974
F. E. Bupp Sep. 1974 161 p refs
(Contract F04611-71-C-0010)
(AD-A001666; TRW-16740-6005-RV-00-Vol-1;
AFRPL-TR-74-53-Vol-1) Avail: NTIS CSCL 21/9

A configuration of the nucleonic gauging system denoted the Flight Test Article, which is suitable to demonstrate gauging performance in a zero-g environment as provided by the Zero-G KC-135 aircraft flying a parabolic trajectory, was designed, fabricated, and delivered to NASA. The gauging system is projected to yield a total system accuracy of 0.25 percent of total tank capacity with a 1-second response time. The system is completely compatible with the requirements of the KC-135 aircraft and will not present any undue hazard to ground or flight personnel. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N75-32441* National Aeronautics and Space Administration. Pasadena Office, Calif.
INERT GAS METALLIC VAPOR LASER Patent
Gary R. Russell (JPL), Noble M. Nerheim (JPL), and Thomas J. Pivirotto, inventors (to NASA) (JPL) Issued 16 Sep. 1975 23 p Filed 3 Dec. 1973 Supersedes N74-16187 (12 - 07, p 0804) Sponsored by NASA
(NASA-Case-NPO-13449-1; US-Patent-3,906,398;
US-Patent-Appl-SN-420813; US-Patent-Class-331-94-5G;
US-Patent-Class-330-4.3; US-Patent-Class-310-11;
US-Patent-Class-331-94.5PE) Avail: US Patent Office CSCL 20E

An inert gas-copper vapor laser is described which consists of a multichamber structure, in which inert gases are heated and mixed with copper powder which is then vaporized, and an inert gas-copper vapor mixture is established in a plenum chamber. The inert gas copper vapor mixture, referred to as the lasant, passes from the plenum chamber through a nozzle into a laser chamber. Positioned in the laser chamber are a pair of spaced apart mirrors and a pair of spaced apart electrodes which together form a cylindrical laser cavity through which the lasant flows. One or both electrodes are comb-shaped. Each comb-shaped electrode consists of a plurality of equal length wires, all of which are connected together at a common terminal. The ends of the wires define tips which are equally spaced apart in a direction parallel to the cavity axis and are equally spaced therefrom. Current discharge due to a current pulse applied to the electrodes takes place at the wires tips. Each electrode is protected by a boron nitride electrode protective member which is slotted so that only the tips of the wires are exposed to the opposite electrode and to the hot plasma flowing between the electrodes through the laser cavity.
Official Gazette of the U.S. Patent Office

N75-32442 Boston Univ., Mass.
QUANTUM MECHANICAL THEORY OF ORGANIC DYE LASER Ph.D. Thesis
Raymond Bruce Schaefer 1975 171 p
Avail: Univ. Microfilms Order No. 75-21013

This dissertation contains a fully quantum mechanical theory for the organic dye laser. Using the Born-Markoff master equation, the density matrix equations of motion for the organic dye laser is obtained. These equations are used for the radiation distribution in the steady state. The investigation of the result shows that the organic dye laser radiation distribution has features qualitatively different from that of other lasers. The organic dye laser has four levels which interact directly with the laser radiation. There are two singlet state levels which are predominantly emissive and two triplet levels which are predominantly absorptive. In addition, the triplet state population is directly related to the singlet state population. It is the presence of these triplet states

which make the dye laser different from other lasers.
Dissert. Abstr.

N75-32443*# Union Coll., Schenectady, N.Y. Dept. of Electrical Engineering.
DESIGN AND ANALYSIS OF OPTICALLY PUMPED SUBMILLIMETER WAVEGUIDE MASER AMPLIFIERS AND OSCILLATORS Interim Technical Progress Report, 1 Feb. - 31 Jul. 1975
Thomas A. Galantowicz 31 Jul. 1975 25 p refs
(Grant NGR-33-032-004)
(NASA-CR-119130) Avail: NTIS HC $3.25 CSCL 20E

The design and experimental measurements are described of an optically pumped far-infrared (FIR) waveguide maser; preliminary measurements on a FIR waveguide amplifier are presented. The FIR maser was found to operate satisfactorily in a chopped CW mode using either methanol (CH3OH) or acetonitrile (CH3CN) as the active molecule. Two other gases, difluoroethane and difluoroethylene, produced an unstable output with high threshold and low output power when operated in the chopped CW mode. Experimental measurements include FIR output versus cavity length, output beam pattern, output power versus pressure, and input power. The FIR output was the input to an amplifier which was constructed similar to the oscillator. An increase of 10% in output power was noted on the 118.8 microns line of methanol. Author

N75-32444# United Technologies Research Center, East Hartford, Conn.
HF CHAIN REACTION LASER Final Technical Report
L. R. Boedeker, J. F. Verdieck, and R. J. Hall May 1975 60 p refs
(Contract N00014-74-C-0379)
(AD-A009853; R75-951883-4) Avail: NTIS CSCL 07/4

The report describes a thermally initiated F2/H2 flow tube reactor experimental program to provide clearly defined experimental results via emission spectroscopy diagnostics on vibrational population levels attained in the CW H2/F2 chain reaction for comparison with theory. Highly dilute, subsonic, near room temperature reaction conditions in the 1-10 torr pressure region have been studied which result in development of the chain over flow tube distances of about 1 meter, much larger than mixing length. An examination of the dominant kinetics was conducted via the accumulation of spectral and UV data over a range of key experimental parameters including distance from the H2 injector, x; H2 flow; F2 flow pressure; dissociator temperature, and O2 additive flow. Overtone spectra were obtained. The experimental results from the flow tube on high lying vibrational population distributions observed at 5 torr have been compared with predictions of the 1-D scheduled mixing analytical model in a manner which attempts to identify potential key areas of kinetic uncertainty with the chain. GRA

N75-32445# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
EFFECTS OF ION BEAM POLISHING ON ALKALI HALIDE LASER WINDOW MATERIALS
J. A. Bruce, J. J. Comer, C. V. Collins, and H. G. Lipson 7 May 1975 15 p refs
(AF Proj. 5620)
(AD-A010459; AFCRL-TR-75-0257) Avail: NTIS CSCL 20/5

Samples of single crystal KCl, KCl-KBr, and polycrystalline pressure-induced recrystallized KCl were polished using an argon ion beam. The specimens were rotated at a constant rate during bombardment. The angle-of-incidence of the ion beam, the ion current, and the time of sample exposure were varied. After polishing the surfaces of the samples were examined by X-ray topography, scanning electron microscopy, transmission electron microscopy, and Nomarski techniques and the absorption coefficient of the materials was measured. The effects of different polishing rates and angles-of-incidence on surface quality and absorption characteristics of the selected alkali halide laser window materials are discussed. GRA

N75-32446# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTICS RESEARCH: 1974:2 Semiannual Report, 1 Jul. - 31 Dec. 1974
Robert H. Rediker 31 Dec. 1974 49 p refs
(Contract F19628-73-C-0002; ARPA Order 600)
(AD-A010476; ESD-TR-75-107) Avail: NTIS CSCL 20/5

Research in laser technology, thermal blooming of successive laser pulses, and optical instruments is reviewed. Other topics discussed include multiple-pulse blooming of focused beam in a uniform wind, laboratory experiment on thermal blooming, impulsive loading of targets by high frequency laser pulses, double-pulse pressure and impulse measurements, ballistic pendulum for high-lower laser measurements, laser heating of metallic surfaces, plasma enhancement of thermal coupling to targets, stable CO2 laser measurements, pollution studies, the St. Louis regional air pollution study, and diode laser multi-pollutant ambient-air monitoring. Author

N75-32447# Naval Research Lab., Washington, D.C.
TOWARDS SHORTER WAVELENGTH LASERS AND BREAKING THE 1000 ANGSTROM BARRIER-3 (RECOMBINATION)
A. W. Ali and W. W. Jones Mar. 1975 25 p refs
(NRL Proj. N01-33)
(AD-A009737; NRL-MR-3015) Avail: NTIS CSCL 07/4

The physics of recombination in a multi-ionized and dense plasma is discussed. Emphasis is given to such a medium as a potential source for VUV and X-ray lasers. Results of some model calculations for hydrogen and C(+5)(lambda = 34A) are presented. Author

N75-32448# Princeton Univ., N.J. Dept. of Chemistry.
COLLISION STUDIES OF GASEOUS MOLECULAR LASERS
Herschel Rabitz 20 May 1975 21 p refs
(Contract N00014-75-C-0478)
(AD-A010204; PR-1) Avail: NTIS CSCL 07/4

Collisional relaxation studies under way at Princeton are reviewed. Three areas of research are involved: Vibration-translation rate calculations in He-CO; rotation-translation relaxation in hydrogen; and a stochastic theory for strong collisions. GRA

N75-32449# Naval Ordnance Lab., White Oak, Md.
THE EFFECTS OF HEAVY WATER (D2O) AS A CATALYST IN A CO2-N2 GASDYNAMIC LASER
John S. Vamos Dec. 1974 24 p refs
(AD-A010196; NOLTR-74-216) Avail: NTIS CSCL 20/5

The results of an experimental shock tunnel investigation of the effects of varying heavy water concentration and temperature on the small-signal-gain of a gasdynamic laser are presented. Comparisons of experiment with numerical predictions of small-signal-gain are made as well as a comparison of heavy water with water as a catalyst for a gasdynamic laser. GRA

N75-32450# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Microwave Physics Lab.
PROPAGATION IN TURBULENT MEDIA: A REVIEW OF RECENT PROGRESS Physical Sciences Research Papers
Ronald L. Fante 24 Feb. 1975 41 p refs
(AF Proj. 2153)
(AD-A010413; AFCRL-TR-75-0105; AFCRL-PSRP-626) Avail: NTIS CSCL 20/6

In this report the author has reviewed the recent developments on beam propagation in a turbulent medium. These include the effect of the turbulence on beam intensity, spread, coherence, wander, angle of arrival, scintillation and distortion, as well as other related topics. GRA

N75-32451# Army Foreign Science and Technology Center, Charlottesville, Va.
FIELD FLUCTUATIONS OF A LASER BEAM PROPAGATING IN A TURBULENT ATMOSPHERE
V. L. Moronov and G. Ya. Patrushev 27 Aug. 1974 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii. Radiofizika (USSR), 1972
(AD-A001222; FSTC-HT-23-472-74) Avail: NTIS CSCL 20/5

Using the approximating method of smooth perturbations, the variance, correlation, and structural functions of the fluctuations of the logarithm of the amplitude and phase of a laser beam propagating in a turbulent atmosphere were analyzed numerically as a function of the dimensions of the emitting aperture, the

focussing radiation conditions, and the coordinates of the observation points in the plane perpendicular to the beam axis. GRA

N75-32452# Systems Research Labs., Inc., Dayton, Ohio.
DESIGN, CONSTRUCTION, AND OPERATION OF AN EXPERIMENTAL SYSTEM FOR STUDY OF LASER ENERGY ENHANCEMENT BY MAGNETIC FIELDS Final Report, 15 Apr. 1973 - 15 Jul. 1974
Daniel R. Nordlund Feb. 1975 36 p
(Contract F33615-73-C-4097; AF Proj. 7073)
(AD-A010490; SRL-6787; ARL-75-0009) Avail: NTIS CSCL 20/5

An experimental system has been designed and constructed for the study of iodine laser energy enhancement. The system is an oscillator-amplifier combination in which the energy storage capability of the amplifier is increased by the application of an inhomogeneous magnetic field which provides a spatial variation in the frequency profile of the induced emission coefficient. Photo-dissociative flux is provided by high energy linear flashlamps. The coaxial lamp current path produces no net force on the lamp structure; therefore, even with high lamp currents (up to 20 kA) and high magnetic fields (up to 100 kG), satisfactory lamp operation can be achieved. This report outlines the overall design and operation of the experimental apparatus, including the electrical system, vacuum/gas handling system, power amplifier/master oscillator system, and optical system. A discussion of the flashlamps, including results of the initial flashlamp study and flux measurement, is included in the section on the electrical system. GRA

N75-32453# Pennsylvania State Univ., University Park. Materials Research Lab.
COATING SCIENCE AND TECHNOLOGY Final Report, 25 Apr. 1973 - 31 Dec. 1974
B. E. Knox and K. Vedam 31 Jan. 1975 56 p refs
(Contract F19628-73-C-0219; ARPA Order 2415)
(AD-A010457; AFCRL-TR-75-0152) Avail: NTIS CSCL 20/5

The objective of this research program was to develop a thorough understanding of the science and technology of films applied as coatings on materials transparent to 10.6 and 3-5 micron radiation. The approach included preparation of films by sputtering, evaporation and CVD techniques. Topics discussed include the following: selection of materials; preparation of substrate surface; first-layer films of germanium on potassium chloride substrates; first-layer films of cadmium telluride on potassium chloride; tetrahedral carbon films; plasma-polymerized films; durability testing of thin films; determination of stress-optic coefficient of ZnSe at 10.6 micrometers. GRA

N75-32454# Martin Marietta Aerospace, Orlando, Fla.
WIDEBAND INTERMEDIATE LASER AMPLIFIER TECHNIQUES Final Report, 10 Jan. - 15 Oct. 1974
James M. Martin, William T. Smith, and Ira C. Crabbe Apr. 1975 58 p refs
(Contract F30602-74-C-0098; AF Proj. 6527)
(AD-A010472; RADC-TR-75-99) Avail: NTIS CSCL 20/5

This contract falls in the area of laser radar transmitter technology, since it was an engineering study of a wideband intermediate stage laser amplifier, using laboratory hardware, to verify predicted performance, and arrive at a conceptual design for a practical device. This type of amplifier is needed for the implementation of several types of high resolution laser radar systems. The amplifier would be capable of amplifying frequency swept synthetic imaging radar waveforms of microseconds duration and 500 MHz sweep extent, generated by a master oscillator, to a level sufficient to drive a laser power amplifier. The conceptual design resulting from this study calls for a 200 torr laser gas pressure, a pulse/RF gas discharge ionization/excitation technique, and a closed cycle, flowing gas, transverse discharge, transverse cavity laser configuration in order to meet the waveform amplification requirements. GRA

N75-32455# Naval Research Lab., Washington, D.C.
ARPA/NRL X-RAY LASER PROGRAM Semiannual Technical Report, 1 Jul. - 31 Dec. 1974
May 1975 188 p refs
(ARPA Order 2694; NRL Proj. N01-43; NRL Proj. N01-33)
(AD-A010516; NRL-MR-3057) Avail: NTIS CSCL 03/2

This is the second semiannual technical report for the ARPA/NRL X-ray Laser Program. The individual activities in the program include: electron collisional pumping using picosecond laser heating of a cold plasma; traveling wave (TW) high energy electron beam pumping; nonlinear optical mixing starting with intense 1600 A radiation; resonant charge transfer pumping using a laser plasma expanding into a neutral gas background, and theory, analysis, and numerical modeling in support of the above and other approaches. Some reprints of completed papers are included. GRA

N75-32456# Range Commanders Council, White Sands Missile Range, N.Mex.
CONFERENCE ON COHERENT RADARS FOR RANGE INSTRUMENTATION Final Report
Mar. 1974 258 p refs Conf. held at Vandenberg AF Base, Calif., 5-7 Mar. 1974
(AD-A010320) Avail: NTIS CSCL 17/9

The theme of the conference concerned what has been the past performance and what is the future potential of Coherent Radars for test support instrumentation. In addition, emphasis was placed upon preparation for the upcoming GEOS-C launch. This publication contains outlines and excerpts from the various conference briefings. GRA

N75-32457# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
SUMMARY OF THE SECOND INTERNATIONAL WORKSHOP ON LASER VELOCIMETRY
H. D. Thompson and W. H. Stevenson Mar. 1975 19 p
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-A010223; SQUID-TR-PU-R1-75) Avail: NTIS CSCL 20/5

This report contains a listing of the papers and brief comments upon the Second International Workshop on Laser Velocimetry held at Purdue University on March 27-29, 1974. The purpose of the workshop was to bring together active workers in the relatively new field of Laser Velocimetry from the United States and Western Europe for open discussion and exchange of ideas and recent developments. During the two and a half day workshop a total of 44 formal papers were presented and 22 informal reports were presented. GRA

N75-32458# Harry Diamond Labs., Adelphi, Md.
HIGH ENERGY LASER TECHNOLOGY ASSESSMENT. VOLUME 1: THE TECHNOLOGY ASSESSMENT- AN INITIAL STUDY Final Report, Sep. 1973 - Jan. 1975
Edward A. Brown and Marvin V. Jones Jan. 1975 74 p refs Sponsored by Army
(AD-A010100) Avail: NTIS CSCL 20/5

A technology assessment has been performed on the topic of high-energy lasers for the purpose of acquainting the Army Staff with this relatively new concept in R and D Management. Volume 1 of this three-volume report contains the technology assessment itself which consists of a brief description of the technology, followed by an abreviated impact analysis whose intent is to be illustrative of the methodology, rather than be a comprehensive treatment of the subject. GRA

N75-32459# Harry Diamond Labs., Adelphi, Md.
HIGH ENERGY LASER TECHNOLOGY ASSESSMENT. VOLUME 2. PROJECT MANAGER'S REPORT - HISTORY AND LESSONS LEARNED Final Report, Sep. 1973 - Jan. 1975
Edward A. Brown and Joel D. Goldhar Jan. 1975 51 p refs Sponsored by NSF
(AD-A010101) Avail: NTIS CSCL 20/5

Volume 2 of the High-Energy Laser Technology Assessment (HELTA) will address itself to the questions how and why the TA was carried out, rather than to the actual impacts of high-energy lasers. The intent is to provide reference material for a future member of the Army staff to use when called upon to perform a TA. The need for the Army to become acquainted with the principles of TA was perceived about two years ago, when Congress passed the Technology Assessment Act of 1972 and created the Office of Technology Assessment. Having neither experience nor expertise in the field, the decision was made to

gain both by simply doing a TA, looking at it critically, evaluating mistakes and successes, and then setting down a record by which future technology assessment project managers might be guided. This volume is that record. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N75-32460 Ohio State Univ., Columbus.
AN EXPERIMENTAL STUDY OF THE TRANSITION FROM STATIC TO KINETIC SLIDING FRICTION BETWEEN TRANSLATING SOLID BODIES UNDER OSCILLATORY MOTION CONDITIONS Ph.D. Thesis
Joseph Herman Gallenstein, Jr. 1975 308 p
Avail: Univ. Microfilms Order No. 75-19439

Frictional behavior under reciprocating conditions was investigated in order to establish patterns of behavior useful in developing a better model than the classical model proposed by Coulomb and first put into equation form by Euler. To do this, a test apparatus was designed and constructed using a hydraulic servomechanism to produce the linear oscillations of one member of the friction pair relative to the other member. The friction pair consisted of a spherical pin and a flat. The friction force was measured by mounting one friction member on a stiff elastic member whose deflection was sensed using unbonded strain gages. Relative velocity was monitored using a noncontacting transducer consisting of a coil through which a magnetic core moved. Various theoretical reasons for the velocity dependent frictional behavior and the changes in the static friction were advanced. Results of the testing were used to develop a friction model useful in dynamic analysis of systems such as positioning control systems and in systems where frictional behavior under reciprocating conditions is important. Dissert. Abstr.

N75-32461 Princeton Univ., N.J.
A THEORY OF TURBULENT COMBUSTION AND NITRIC OXIDE FORMATION FOR DUAL-CARBURETED STRATIFIED-CHARGE ENGINES Ph.D. Thesis
Josette Rosentweig Bellan 1974 323 p
Avail: Univ. Microfilms Order No. 75-20612

A theoretical model of turbulent flame propagation in reciprocating stratified charge engines was developed. A spacial variation of mixture ratio is considered such that there is a fuel rich region in the center of the cylinder and a fuel lean region near the cylinder walls. The spark in the fuel rich region results in a premixed type of flame propagating toward the walls. A diffusion-type flame results in the wake of the other flame due to the mixing of the excess air and fuel. Two models are compared. The first one is based upon a prescribed time variation of the turbulent diffusivity depending upon the piston velocity. In the second one, a two-turbulent-equations model was developed and the turbulent diffusivity varies in space and time as well. In both models calculations of the temperature and species mass fractions as functions of time and space are made. The pressure is calculated as a function of time. Dissert. Abstr.

N75-32462*# General Dynamics/Electronics, San Diego, Calif. Microelectronics Center.
HIGH RELIABILITY BOND PROGRAM USING SMALL DIAMETER ALUMINUM WIRE Final Report
Milo Macha and R. A. Thiel Jul. 1975 55 p refs
(Contract NAS8-30877)
(NASA-CR-143946; R-75-022) Avail: NTIS HC $4.25 CSCL 13H

The program was undertaken to characterize the performance of small diameter aluminum wire ultrasonically bonded to conductors commonly encountered in hybrid assemblies, and to recommend guidelines for improving this performance. Wire, 25.4, 38.1 and 50.8 um (1, 1.5 and 2 mil), was used with bonding metallization consisting of thick film gold, thin film gold and aluminum as well as conventional aluminum pads on semiconductor chips. The chief tool for evaluating the performance was the double bond pull test in conjunction with a 72 hour - 150 C heat soak and -65 C to +150 C thermal cycling. In practice the thermal cycling was found to have relatively little effect compared to the heat soak. Pull strength will decrease after heat soak as a result of annealing of the aluminum wire; when bonded to thick film gold, the pull strength decreased by about 50% (weakening of the bond interface was the major cause of the reduction). Bonds to thin film gold lost about 30 - 40% of their initial pull strenth; weakening of the wire itself at the bond heel was the predominant cause. Bonds to aluminum substrate metallization lost only about 22%. Bonds between thick and thin film gold substrate metallization and semiconductor chips substantiated the previous conclusions but also showed that in about 20 to 25% of the cases, bond interface failure occurred at the semiconductor chip. Author

N75-32463*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PLASMA-SPRAYED, SELF-LUBRICATING COATINGS FOR USE FROM CRYOGENIC TEMPERATURES TO 870 DEG C (1600 DEG F)
Harold E. Sliney [1975] 13 p refs
(NASA-TM-X-71798; E-8476) Avail: NTIS HC $3.25 CSCL 11H

A plasma-sprayed coating is described with good lubricating properties over a wide temperature range. The coating, designated NASA LUBE PS101, contains silver, nichrome, calcium fluoride, and an oxidation protective glass. Oscillating tests were conducted of self-aligning, plain cylindrical bearings, in which the bore was lined with 0.025 cm (0.010 in.) thick coatings of PS101; these were conducted at a radial load of 3.5 x 10 to the 7th power N/sq m (5000 psi) in nitrogen gas at -107 C (-160 F), in vacuum at room temperature, and in air from room temperature to 870 C (1600 F). Friction coefficients were less than 0.25 in all cases and wear rates were low. The coating is not brittle, and it has adequate oxidation resistance in air to at least 870 C. Author

N75-32464*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EDITING OF EIA CODED, NUMERICALLY CONTROLLED, MACHINE TOOL TAPES
John M. Weiner 1 Oct. 1975 7 p refs
(Contract NAS7-100)
(NASA-CR-119150; JPL-TM-33-739) Avail: NTIS HC $3.25 CSCL 13H

Editing of numerically controlled (N/C) machine tool tapes (8-level paper tape) using an interactive graphic display processor is described. A rapid technique required for correcting production errors in N/C tapes was developed using the interactive text editor on the IMLAC PDS-ID graphic display system and two special programs resident on disk. The correction technique and special programs for processing N/C tapes coded to EIA specifications are discussed. Author

N75-32465*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PNEUMATIC LOAD COMPENSATING OR CONTROLLING SYSTEM Patent Application
James R. Rogers, inventor (to NASA) Filed 6 Oct. 1975 16 p
(NASA-Case-ARC-10907-1; US-Patent-Appl-SN-619986) Avail: NTIS HC $3.25 CSCL 13G

A pneumatic load compensating or controlling system for restraining a load with a predetermined force or applying a predetermined force to the load is described; it includes a source of pressurized air, a one-way pneumatic actuator operatively connected to a load, and a fluid conduit fluidically connecting the actuator with the source of pressurized air. The actuator is of the piston and cylinder type, and the end of the fluid conduit is connected to the upper or lower portion of the cylinder whereby the actuator alternatively and selectively restrains the load with a predetermined force or apply a predetermined force to the load. Pressure regulators are included within the system for variably selectively adjusting the pressurized fluid to predetermined values as desired or required; a pressure amplifier is included within the system for multiplying the pressurized values so as to achieve greater load forces. An accumulator is incorporated within the system as a failsafe operating mechanism, and visual and aural alarm devices, operatively associated with pressure

detecting apparatus, readily indicate the proper or improper functioning of the system. NASA

N75-32466# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE EFFECT OF SHAPE AND DIMENSIONS OF DIES ON TECHNOLOGICAL PARAMETERS ON THE FORGING PROCESS
V. A. Korzunov and G. P. Teterin 12 Dec. 1974 27 p refs Transl. into ENGLISH from Mono. Vychislitelnaya Tekhn. v Mashinostr. (Minsk), Dec. 1970 p 104-114
(AD-A006828; FTD-HC-23-2880-74) Avail: NTIS CSCL 13/8

Data are presented which describe the functional tie between elements of geometric form and the dimensions of billets elongated in the plane view and the parameters of the burr groove of die. GRA

N75-32467# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
BASIC RESEARCH IN DYNAMIC SEALING Annual Summary Report, 1 Sep. 1973 - 31 Aug. 1974
H. J. Wilkerson, C. J. Bliem, T. V. Blalock, and C. R. Brooks Dec. 1974 47 p refs
(Contract N00014-68-A-0144)
(AD-A010530; ME74-T57-19) Avail: NTIS CSCL 11/1

Progress on the development of instrumentation for dynamically measuring pressure, temperature, and film thickness without disturbing the flow field in a mechanical face seal test facility is reported. The fabrication techniques and progress in probe developments of both a pressure transducer and a non-pentrating inductance probe for direct measurement of the local thin film clearance are reported. A summary of the interfacial wear studies using electron microscope examination of surface topography and subsurface microstructure is reported for several materials of interest in mating surfaces of mechanical face seals. GRA

N75-32468# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
AN EXPERIMENTAL INVESTIGATION OF A RADIAL FACE SEAL
George M. Kiber Jun. 1975 111 p refs
(Contract N00014-75-C-0390)
(AD-A010531; ME75-T57-21) Avail: NTIS CSCL 11/1

An experimental method was developed which will allow a complete description of the interface fluid film of a radial face seal. The equipment necessary for the monitoring of the vertical load, torque, temperature, supply pressure, interface pressure, interface clearance, and rotational speed has been integrated into a workable facility. The procedures needed for the operation of this equipment were derived and are presented. GRA

N75-32469# Wisconsin Univ., Madison. Mathematics Research Center.
INVESTIGATION OF SPIKING IN ELECTRON BEAM WELDING USING STATIONARY STOCHASTIC MODELS Technical Summary Report
M. S. Phadke, A. M. Joglekar, and S. M. Wu Mar. 1975 22 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010096; MRC-TSR-1509) Avail: NTIS CSCL 13/8

The spiking phenomenon in electron beam welding is characterized using the second order continuous autoregressive model. The model parameters are then physically interpreted in terms of the random fluctuation in the beam power and the diffusion of heat energy in the plates being welded; and a mechanistic model is proposed for the spiking phenomenon. Finally, regression models are obtained to relate the spiking behaviour to the accelerating voltage, the beam current and the welding speed. GRA

N75-32470# Transportation Systems Center, Cambridge, Mass.
STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. FUEL ECONOMY TEST PROCEDURE PANEL REPORT NO. 6 Special Congressional Report, Jun. - Oct. 1974
Harold G. Miller 10 Jan. 1975 82 p refs Prepared in cooperation with Comm. on Com., Comm. on Interstate and Foreign Com. and EPA, Washington, D. C.
(PB-241776/4; DOT-TSC-OST-75-15) Avail: NTIS HC $4.75; also avail. $29.00/set of 8 reports as PB-241769-SET CSCL 21D

This report presents the test procedures recommended for insuring compliance with fuel economy regulations. Discussions included are: (a) driving variables pertinent to the establishment of a meaningful, reproducible test methodology; (b) test and measurement methods which are applicable to fuel economy certification tests; (c) current test procedures in use by industry and the federal government, and (d) recommendations for a standardized Federal test procedure. GRA

N75-32471# Transportation Systems Center, Cambridge, Mass.
STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. TECHNOLOGY PANEL REPORT NO. 4 Special Congressional Report, Jun. - Oct. 1974
Harold G. Miller 10 Jan. 1975 167 p refs Prepared in cooperation with Comm. on Com., Comm. on Interstate and Foreign Com., and EPA, Washington, D. C.
(PB-241774/9; DOT-TSC-OST-75-13) Avail: NTIS HC $6.25; also avail: $29.00/set of 8 reports as PB-241769-SET CSCL 21D

The authors evaluate individual technologies which could produce improved automobile fuel economy in the areas of vehicle improvement (reduced weight and aerodynamic drag), transmission improvement, engine improvements and reduced performance acceleration. Potential 1980 fuel savings are estimated for each of these technologies. The more promising of these technologies are combined in several different configurations to produce estimates of potential automobile fuel savings possible by 1980. GRA

N75-32472# Transportation Systems Center, Cambridge, Mass.
STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. AIR QUALITY AND EMISSIONS PANEL REPORT NO. 3 Special Congressional Report, Jun. - Oct. 1974
Harold G. Miller 10 Jan. 1975 42 p Prepared in cooperation with Comm. on Com., Comm. on Interstate and Foreign Com., and EPA, Washington, D. C.
(PB-241773/1; DOT-TSC-OST-75-12) Avail: NTIS HC $3.75; also avail. $29.00/set of 8 reports as PB-241769-SET CSCL 21D

The report describes the factors which affect air quality, i.e., number and kind of stationary emission sources, the motor vehicle fleet mix, and number of vehicle miles traveled by each class of vehicle. The effect various fuel economy strategies will have on air quality are discussed. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N75-32473*# National Aeronautics and Space Administration, Washington, D.C.
ANALYTICAL TECHNIQUES: A COMPILATION Technology Utilization
Jan. 1975 35 p
(NASA-SP-5972(04)) Avail: NTIS HC $3.75 CSCL 14D

A compilation, containing articles on a number of analytical techniques for quality control engineers and laboratory workers, is presented. Data cover techniques for testing electronic, mechanical, and optical systems, nondestructive testing techniques, and gas analysis techniques. Author

N75-32474# Army Missile Test and Evaluation Directorate, White Sands Missile Range, N.Mex.
FIVE STATISTICAL TESTS TO DETERMINE THE NATURE OF THE FAILURE RATE: A SPECIAL RAM METHODOLOGY REPORT
Gideon A. Culpepper May 1975 21 p refs
(AD-A010340) Avail: NTIS CSCL 14/4

Five statistical tests are presented for verifying whether or not the failure rate is constant. Two tests are given to determine if a constant failure rate exists. The other three tests determine whether a constant, increasing, or decreasing failure rate exists. Tables needed for three of the tests are included. Also, a numerical example is presented in which three of the tests are used for comparing results. GRA

N75-32475# Polytechnic Inst. of New York, Brooklyn. Dept. of Electrical Engineering and Electrophysics.
CONFIDENCE BOUNDS AND PROPAGATION OF UNCERTAINTIES IN SYSTEM AVAILABILITY AND RELIABILITY COMPUTATIONS
Leonard Shaw and Martin L. Shooman Feb. 1975 26 p refs
(Contract N00014-67-A-0438-0013; NR Proj. 042-301)
(AD-A010198; POLY-EE/EP-75-002; PINY-EER-114) Avail: NTIS CSCL 14/4

This paper develops bounds on the uncertainties in system availabilities or reliabilities which have been computed from structural (series, parallel, etc.) relations among uncertain subsystem availabilities or reliabilities. It is assumed that the highly available (reliable) subsystems have been tested or simulated to determine their unavailabilities (unreliabilities) to within some small percentages of uncertainty. It is shown that series, parallel and r out of n structures which are nominally highly available will have unavailability uncertainties whose percentage errors are of the same order as the subsystem uncertainties. Thus overall system analysis errors, even for large systems, are of the same order of magnitude as the uncertainties in the component probabilities. Both systematic (bias type) uncertainties and independent random uncertainties are considered. GRA

N75-32476# Martin Marietta Aerospace, Orlando, Fla.
REVISION OF RADC NONELECTRONIC RELIABILITY NOTEBOOK RADC-TR-69-458, SECTION 2 Final Report, Feb. 1973 - Jun. 1974
Donald F. Cottrell, Thomas R. Gagnier, Edwin W. Kimball, and Thomas E. Kirejczyk Oct. 1974 99 p refs
(Contract F30602-73-C-0135; AF Proj. 5519)
(AD-A002152; OR-13165) Avail: NTIS CSCL 14/4

Martin Marietta conducted a 15-month program to revise Section 2, Part Failure Data, of the RADC Nonelectronic Reliability Notebook, RADC-TR-69-458. This report describes the methodology, analyses, and ground rules involved in that effort, and summarizes the approximate 835 billion part-hours of operating data collected. The data covered over 300 major part-classes and subclasses in eight different military environments. GRA

N75-32477# RCA Labs., Princeton, N.J.
INTEGRATED CIRCUIT RELIABILITY AND MANUFACTURING SCIENCE PROGRAM Final Report
Joseph H. Scott, Kenneth R. Keller, and Peter A. Crossley Dec. 1973 97 p refs
(Contract N00039-73-C-0060)
(AD-A009996; PRRL-73-CR-62) Avail: NTIS CSCL 09/5

The report describes results of a study aimed at lowering the cost of high-reliability integrated circuits. The circuit family chosen for the study was RCA's CMOS product line, and recommendations are developed specifying changes in the existing process line, aimed at improving the reliability of the finished products. The intention has been to provide reliability inspection and quality control procedures which can be distributed throughout the manufacturing process, replacing the present approach of performing all high-reliability screening at the end of the manufacturing process. The cost and trade-offs of implementing these changes have been analyzed where possible. Where such analysis was not possible, a research schedule was prepared to provide the data necessary for evaluation of the proposed change. The most important of the proposed changes form an integrated concept in which wafers move through an automated production line under computer control. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N75-32478 South Carolina Univ., Columbia.
A RATIONAL METHOD FOR THE DETERMINATION OF A STRAIN ENERGY DENSITY FUNCTION FOR LARGE ELASTIC DEFORMATIONS OF RUBBER LIKE MATERIALS Ph.D. Thesis
William Drayton Wilson 1974 127 p
Avail: Univ. Microfilms Order No. 75-16501

Strain-energy density measurements were used at points along the stress-strain curves experimentally developed for the pure homogeneous strain paths of simple elongation, pure shear and equal-biaxial extension. Based on the premise that all external work done in causing the elastic deformations is stored as internal mechanical energy, these measurements were taken by finding the area under the curve up to each of the points at which the value of the strain-energy density was desired. At each of these points, the numerical values were then calculated for each of the two independent strain invariants strain-energy density measurement was made. A plot was then made of the strain-energy density versus the values of the corresponding strain invariants. Dissert. Abstr.

N75-32479 Columbia Univ., New York.
LARGE DEFORMATIONS OF AN ELASTIC SHELL IN A VISCOUS FLUID Ph.D. Thesis
Paul Richard Zarda, Jr. 1975 159 p
Avail: Univ. Microfilms Order No. 75-18455

A method is developed for computing large axisymmetric deformations of an elastic shell loaded either by uniform pressures or the viscous stresses of an incompressible fluid flow inside and/or outside the shell. The flow is assumed to be slow enough so that inertial terms may be neglected. A variational principle is presented whose variation can be shown to satisfy all the governing equations and boundary conditions. Solutions are determined by means of a finite element approximation. In determining the large deformations of the shell, a N-dimensional Newton-Raphson iterative procedure is used. Static and quasi-static problems in the area of blood flow and the deformation of the red blood cells are solved. Such problems include the sphering of a red blood cell, the formation of the red blood cell, and the deformation of red blood cells in flow in small capillaries. Dissert. Abstr.

N75-32480 Connecticut Univ., Storrs.
A GENERAL THEORY OF ELASTIC/VISCOELASTIC MULTI-LAYERED PLATES Ph.D. Thesis
Lawrence Lee Durocher 1975 159 p
Avail: Univ. Microfilms Order No. 75-18331

No restrictions are placed on the relative thicknesses, densities, elastic moduli, or symmetries of the layers. In addition, the formulation accounts for the local shear deformation in each layer as well as the translational and rotational inertia of the composite. Continuity of displacements and stresses is imposed in accordance with a perfect interface bond assumption. Therefore, the equations are applicable to a wide variety of layered plates of arbitrary shape, such as: (1) sandwich plates consisting of two thin faces and a relatively thick but weak core; (2) laminated plates consisting of several layers possessing somewhat similar material and geometric characteristics; (3) elastic plates with symmetric or nonsymmetric viscoelastic coatings; (4) sandwich plates with viscoelastic cores; and (5) homogenous elastic, or viscoelastic plates. Several specific types of material and geometric arrangements are studied. Dissert. Abstr.

N75-32481 Michigan Univ., Ann Arbor.
THE MULTIDIRECTIONAL TENSILE PROPERTIES OF MATERIALS SUBJECTED TO LARGE CYCLIC STRAINS Ph.D. Thesis
Michael Paul Borden 1975 192 p

Avail: Univ. Microfilms Order No. 75-20302

The effects are examined of large cyclic strains on the strength properties of face-centered cubic, single phase metals. Prestrained specimens were sectioned to produce tensile and compressive test specimens representing five different directions relative to the straining direction. The data were correlated to determine the effects of cyclic straining on a material's tensile and compressive yield strengths, tensile ultimate strength, true stress-true strain behavior, tensile and compressive proportional limits, and true strain at maximum load and at fracture. A summation technique for quantifying the effects of cyclic cold working processes was developed. Dissert. Abstr.

N75-32482 Michigan State Univ., East Lansing.
ANALYSIS OF A DYNAMIC SAINT-VENANT REGION IN A SEMI-INFINITE CIRCULAR CYLINDER Ph.D. Thesis
Joseph Francis Binkowski 1975 114 p
Avail: Univ. Microfilms Order No. 75-20812

Response of an elastic, homogeneous, semi-infinite cylinder to dynamic end loadings is studied. These loads consist of harmonic, axisymmetric normal, and shear stresses applied at the finite end, Z = 0. The analytical formulation is based on Cauchy's equations of motion and the dynamic Beltrami-Michell equations of compatibility. The solution of this formulation is expressed in the form of a four vector biorthogonal eigenfunction expansion. The solutions for three different stress distributions at one frequency are examined, revealing nondecaying modes. Eigenvalues are tabulated for six frequencies between 100 and 50,000 cycles per second. Dissert. Abstr.

N75-32483 Connecticut Univ., Storrs.
THE NONLINEAR, DYNAMIC RESPONSE OF AN IMPULSIVELY LOADED CIRCULAR PLATE WITH A CENTRAL HOLE Ph.D. Thesis
Joseph Goldberg 1975 88 p
Avail: Univ. Microfilms Order No. 75-18333

A numerical method, called direct analysis, is described and applied to solve the problem of a plate undergoing a large impulsive load. The method obtains both the transient and static portions of the solution. For generality, an expanded, nonlinear form of the equations of motion is used and shear correction and rotatory inertia are considered. The wave speeds are calculated from the nonlinear equations and appropriate boundary conditions are applied so that reflected waves are included. The results for two types of step loading pulses are presented and compared with previously presented solutions. The response of the plate is discussed and conclusions as to the effects of the nonlinearities are given. The implications of the nonlinear effects for the design of structures are presented. Dissert. Abstr.

N75-32484 Florida Univ., Gainesville.
NONLINEAR ANALYSIS OF DYNAMIC STABILITY OF ELASTIC SHELLS OF REVOLUTION Ph.D. Thesis
Marcus George Hendricks 1974 944 p
Avail: Univ. Microfilms Order No. 75-19343

Two specific areas were treated in detail: (1) the interaction relations for combined dynamic loadings as they interact to cause passage from a dynamically stable state to other states; and (2) the concept of linearized dynamic stability, extended to include geometrically nonlinear effects. Excitation that can possibly occur during the primary dynamic instability motion sufficiently to affect the magnitude of critical dynamic loads was also studied. The dynamic stability characteristics of a conical frustum was studied under a variety of combined dynamic loadings. For the particular loading conditions studied, the results indicate that dynamic instability occurs at loads below critical static loads. This reduction in critical dynamic loads is shown to be the result of both the dynamic load factor effect and of autoparametric excitation. A criterion for dynamic buckling was established based on meridional mode shape changes. Dissert. Abstr.

N75-32485 Florida Univ., Gainesville.
ELASTIC AND VISCOELASTIC SANDWICH PLATES Ph.D. Thesis
Tapan Kumar Ghosh 1974 153 p
Avail: Univ. Microfilms Order No. 75-19336

A nonlinear theory of elastic sandwich plates was developed from the modified Hellinger-Reissner principle in three-dimensional elasticity using a variational method. A consistent method of reducing in steps the most general three-dimensional mixed boundary value problem to, first, a two-dimensional mixed boundary value problem, and then to a single layer or multi-layer plate problem by assuming different displacement functions, is presented. A complete set of equilibrium equations, boundary conditions, compatibility equations, and strain functions in terms of displacement is derived in a unified approach from the variational principle, whereas in earlier theories, the compatibility equations and the relations between strain functions and displacement functions had to be considered separately and a priori. Dissert. Abstr.

N75-32486 Michigan Univ., Ann Arbor.
MATERIAL CHARACTERIZATION IN LARGE DEFORMATION VISCOELASTICITY WITH APPLICATION TO POLYETHYLENE BEHAVIOR AND THIN-WALLED CYLINDER RESPONSE Ph.D. Thesis
Robert Joseph Ganter 1975 156 p
Avail: Univ. Microfilms Order No. 75-20349

An approach which uses stress-strain data history pairs from constant strain rate experiments was developed. Advantages include the elimination of step strain tests and a validation of the resulting stress constitutive equation with respect not only to strain levels but also to strain rates. Practical techniques for experimental data reduction are formulated, and computer programs were written to carry out the calculations. Constant strain rate experiments were performed on high density and low density polyethylene, and the data were reduced assuming that the finite linear viscoelastic material response model developed by Coleman and Noll was applicable. The equilibrium stress response and the time dependent material property functions which arise in the history portion of the stress equation were determined for the uniaxial case. The resulting stress equations accurately predict the stresses over the entire experimental range of strains and strain rates. A biaxial stress equation representative of polyethylene behavior was developed. Dissert. Abstr.

N75-32487 Princeton Univ., N.J.
APPLICATION OF NONLOCAL ELASTICITY TO FRACTURE MECHANICS Ph.D. Thesis
Byoung Sung Kim 1974 76 p
Avail: Univ. Microfilms Order No. 75-20639

The theory of nonlocal elasticity is presented. Its relationship with lattice dynamics is established, and from this the nonlocal elastic moduli are calculated. Nonlocal elasticity is applied to a crack problem to show that stress concentration at the top of the crack is finite and proportional to the square root of the ratio of the crack length to the atomic distance. Based on the finite stress concentration at the crack tip, a new crack propagation criterion is proposed and is compared with the Griffith's criterion and some experimental results. Dissert. Abstr.

N75-32488 Princeton Univ., N.J.
EFFECTS OF INITIAL BENDING ON RESONANCE FREQUENCIES OF CRYSTAL PLATES Ph.D. Thesis
Xanthippi Markenscoff 1974 122 p
Avail: Univ. Microfilms Order No. 75-20648

Formulated in a Lagrangian coordinate system, two-dimensional plate equations in a power-series expansion (according to Mindlin's general procedure) were used to accommodate the coupling of the thickness-shear, thickness-twist, thickness-stretch, flexure, extension and face-shear modes of vibrations superposed on a state of finite deformation due to large initial bending in crystal plates. The nonlinear terms associated with the third-order elastic constants are considered in the stress-strain relations, and the quadratic terms of the rotation are taken into account in the strain-displacement relations. These equations were solved for the case of a circular plate clamped at the edge and loaded transversely at the diametrically opposite point. The changes in the fundamental resonant frequency are computed as a function of the azimuthal angle (between the x-crystallographic axis and the direction of the diameter passing through the load) for AT and BT-cut plates, and comparisons are made with the available experimental data. Dissert. Abstr.

N75-32489 Delaware Univ., Newark.
OPTIMUM HOLE SHAPES FOR STRESS FIELDS Ph.D. Thesis

Gordan Stuart Bjorkman 1975 71 p
Avail: Univ. Microfilms Order No. 75-20549

A fundamental elasticity problem is formulated to determine the geometry of a boundary from prescribed conditions that must be satisfied by the final field stresses. For the planar problem the hole shape termed optimum is the one which satisfies a specific design requirement that the first invariant of the original field remains everywhere unchanged. It is also postulated that such optimum shapes also produce the minimum value possible of maximum tangential stress on the boundary for any hole shape of the same size in that position. Using the complex variable technique a general solution is first obtained in integral form simply in terms of the original free field and any hole boundary loading. The biaxial field and an isotropic field with a linear gradient superimposed, are considered. For each case a uniformly distributed normal stress applied to the unknown hole boundary is included for generality. It is shown that for the biaxial field a properly proportioned and oriented elliptic hole satisfies the design requirement and simultaneously produces the minimum stress concentration for any possible hole shape. Dissert. Abstr.

N75-32490 Case Western Reserve Univ., Cleveland, Ohio.
THE STABILITY OF CYLINDRICAL SHELLS UNDER EXTERNAL PRESSURE Ph.D. Thesis
William Henry Jones 1975 209 p
Avail: Univ. Microfilms Order No. 75-19217

A digital numerical investigation into two analytic theories concerning the stability of cylindrical shells under external pressure was undertaken. An in-depth analysis of the current boiler and pressure vessel code concerning external pressure vessels was performed. Calculations for the theory were extremely difficult. The theory could predict the critical instability load for a cylinder with good agreement with collected data. The theory also provided a prediction for maximum permissible deviation from cylindrical form but could not indicate the exact degradation of load carrying capacity with imperfection. The theory could not be easily made to provide an analytic prediction of the onset of inelastic effect. A possible substitute theory was examined and found in good agreement with collected data. The alternate theory provides an analytic prediction of the degradation of load carrying capacity with cylinder imperfections. Comparisons between the two theories were made and substantial agreement was found. Dissert. Abstr.

N75-32491 Cincinnati Univ., Ohio.
STABILITY OF LAMINATED STIFFENED PRISMATIC STRUCTURES Ph.D. Thesis
Hamdy Ahmed Ashour 1975 128 p
Avail: Univ. Microfilms Order No. 75-19551

An analysis is presented which permits the prescription of arbitrary boundary conditions along all the edges of a structure. The concept of buckling is discussed. The relations between the incremental stress resultants and the incremental displacement components of the reference surface of an orthotropic laminated circular cylindrical shell element are treated. The equations of equilibrium of an orthotropic laminated thin circular cylindrical shell element, which is subjected to uniform initial in-plane stresses are treated. A general unified stability analysis for individual orthotropic laminated flat plate and cylindrical shell panels is considered. Also considered is a general unified stability analysis for orthotropic laminated multi-element and stiffened structural panels. A group of computer programs are given. Dissert. Abstr.

N75-32492 California Inst. of Tech., Pasadena.
OPTIMIZATION OF ARCH AND SHELL STRUCTURES Ph.D. Thesis
Marc Jules Moronval 1975 166 p
Avail: Univ. Microfilms Order No. 75-20005

Structural optimization of structures with respect to their shape and thickness distribution was studied using a variational approach. The behavioral constraint is either the state of stress or the stiffness. The boundary value problems, derived using optimal control theory, are solved with the parallel shooting technique. For statically determinant arches subjected to a uniform pressure, the contribution of the shear force is included in the behavioral constraints to prevent the problems from being singular. For the case of membrane shells of revolution supporting a combined pressure and end traction loading case, solutions were obtained up to a critical value of the load coefficient. A physical interpretation of the singularity was obtained by including the possibility of discrete rings in the formulation. A set of optimality conditions for shells of revolution described by the bending theory, satisfying a stiffness constraint, is derived. Dissert. Abstr.

N75-32493 Case Western Reserve Univ., Cleveland, Ohio.
STABILITY OF LINER SHELLS SUPPORTED WITH STUDS ARRANGED ON A DIAMOND PATTERN Ph.D. Thesis
Milton James Schrader 1975 141 p
Avail: Univ. Microfilms Order No. 75-19244

The stability of a cylindrical liner shell supported on a rigid concrete cavity by stud type anchors which are arranged in a diamond shaped pattern was studied. The stud anchors are embedded in the concrete and are assumed to be rigid. Design criteria to prevent buckling of the liner shell was developed through analysis, and a series of experiments was performed to verify the analytical results. The analysis of the buckling phenomena was performed for combined circumferential and axial loadings. Using the large displacement shell equations, the strain energy expression and nonlinear equilibrium equations in terms of the displacements were developed. Several mode shapes which satisfied the boundary conditions imposed by the stud pattern are assumed for the out-of-plane displacement. For several of the assumed mode shapes, the buckled in-plane displacements were obtained in closed form to satisfy the nonlinear equilibrium equations. The total potential energy of the buckled shell is constructed from the assumed displacements. Dissert. Abstr.

N75-32494 New Mexico Univ., Albuquerque.
TRANSIENT RESPONSE OF VISCOPLASTIC AND VISCOELASTIC SHELLS SUBMERGED IN FLUID MEDIA Ph.D. Thesis
Thomas A. Duffey, Jr. 1974 149 p
Avail: Univ. Microfilms Order No. 75-18601

The transient fluid shell interaction problem is investigated for thin shells constructed of other than linearly elastic materials. Specifically, solutions are developed in terms of elementary functions for the transient responses of impulsively loaded, fluid surrounded spherical shells constructed of either viscoplastic or viscoelastic materials. In all cases the fluid medium surrounding the shell is taken as inviscid and compressible and only spherically symmetric shell motions and radiation of sound into the surrounding medium are considered. Elastic-plastic solutions presented are based upon (1) a shell material exhibiting linear strain hardening and linear strain rate sensitivity, and (2) a realistic nonlinear strain rate sensitivity assumption. Solutions utilizing the Kelvin-Voigt and Maxwell viscoelastic models are also presented. It was found that the influence of material strain hardening and strain rate sensitivity is significant in reducing fluid shell displacement response, particularly when the shell is subjected to severe loading well in the plastic range. Dissert. Abstr.

N75-32495 University of Southern Calif., Los Angeles.
FINITE ELEMENT STABILITY ANALYSIS OF CORE STIFFENED SHELLS OF REVOLUTION Ph.D. Thesis
Yuan-Sen Wang 1975 208 p
Avail: Univ. Microfilms Order No. 75-19047

The effect upon the buckling strength of a soft elastic core attached to shell of revolution subjected to anisymmetric load was investigated by the finite element method. The analysis includes: (1) axisymmetric stress analysis of the solid elastic core and shell, (2) determination of an influence coefficient matrix obtained by applying unit loads at the interface nodal points of the elastic core, and (3) stability analysis of the shell of revolution by modifying the shell stiffness matrix and geometric stiffness matrix to include the influence of the core. Sander's thin shell equations were used to develop the thin shell finite element. An eigenvalue subroutine was also developed to extract the eigenvalues using the Sturm sequence method and the eigenvectors were obtained by using the inverse iteration method. Three finite element computer programs were developed parallel to the analysis. Dissert. Abstr.

N75-32496 Waterloo Univ. (Ontario). Solid Mechanics Div.
SOME REMARKS ON LIAPUNOV STABILITY OF ELASTIC DYNAMICAL SYSTEMS
H. H. E. Leipholz Jul. 1974 16 p refs
(Grant NRC-A-7297)
(Paper-132) Avail: Issuing Activity

It is well known that for a conservative elastic system, the Hamiltonian can be used as a Liapunov functional. Data show that for certain kinds of nonconservative systems either this fact remains true or at least a kind of generalized Hamiltonian can be found, which serves the same purpose. A review was made of this theory in the context of conservative systems and some specific types of nonconservative systems were considered for which a Liapunov functional can be specified. Author

N75-32497 Waterloo Univ. (Ontario). Solid Mechanics Div.
STABILITY OF ELASTIC RODS VIA LIAPUNOV'S SECOND METHOD
H. H. E. Leipholz Aug. 1974 14 p refs
(Grant NRC-A-7297)
(Rept-65) Avail: Issuing Activity

Stability of elastic rods subjected to nonconservative tangential follower forces is investigated by means of Liapunov's second method. The result is that such rods are more stable than the same rods loaded correspondingly with vertical conservative forces of equal magnitude. Also, it is found that internal, viscous damping should have a sufficiently large magnitude in order to ensure stability. This is in agreement with the well known fact that small damping destabilizes in the presence of nonconservative forces. Author

N75-32498 Waterloo Univ. (Ontario). Solid Mechanics Div.
THE POST-YIELD STRENGTH OF RC FLEXURAL SECTIONS
E. F. P. Burnett and S. K. Ghosh Jun. 1974 18 p refs Submitted for publication
(Paper-130) Avail: Issuing Activity

Current design standards for reinforced concrete flexural sections explicitly recommend utilization of the post-yield capabilities of the reinforcement. With high tensile steels (grade 60 and grade 75) ultimate strength design procedures considerably underestimate the actual flexural strength of the section. The extent of this conservatism was examined from an experimental and theoretical standpoint. An approach plus a design-oriented expression were developed in order to utilize this available resistance. Author

N75-32499 Waterloo Univ. (Ontario). Solid Mechanics Div.
ON DESTABILIZING PARAMETERS, THE DEGREE OF STABILITY OF MECHANICAL SYSTEMS, AND GENERAL STABILITY CRITERIA
H. H. E. Leipholz Feb. 1975 28 p refs
(Paper-134) Avail: Issuing Activity

Destabilizing parameters and perturbations (buckling loads) are defined, and the concept of a degree of stability and various stability criteria are introduced, of which Liapunov's criterion is a special case. Certain obscurities in stability theory are removed, and stability or instability in creep is considered. Author

N75-32500 Waterloo Univ. (Ontario). Solid Mechanics Div.
ON CONSERVATIVE ELASTIC SYSTEMS OF THE FIRST AND SECOND KIND
H. H. E. Leipholz Jun. 1974 33 p refs
(Paper-129) Avail: Issuing Activity

In introducing the definition of a generalized kind of selfadjointness, it was shown that there are nonconservative systems in the classical sense which in the light of a generalized concept are conservative systems of the second kind. Systems like these buckle by divergence, and possess a generalized conservation theorem and a generalized Rayleigh's quotient. Examples of such systems are given: the pinned-pinned rod, the rod with sliding ends, and the simply supported plate, all of them subjected to compressive follower forces. An example involving a complex differential equation is treated: Greenhill's problem of the torsion of a pinned-pinned shaft. Author

N75-32501 Waterloo Univ. (Ontario). Solid Mechanics Div.
DESIGN OF REINFORCED CONCRETE STRUCTURES FOR STRENGTH AND DEFORMABILITY
Mir M. Ali and Donald E. Grierson Jan. 1974 52 p refs Submitted for publication
(Paper-124) Avail: Issuing Activity

A method of design was developed for reinforced concrete flexural frameworks wherein strength and deformability criteria are simultaneously satisfied at the specified service and ultimate design load levels. A limit design approach is adopted, and the required design moment capacities were found accounting for the same measure of plastic adaptability of reinforced concrete as that recognized by the ultimate strength design method for proportioning sections. The design solution comprises the set of cross-section dimensions and steel percentages for which the members have sufficient post-yielding moment and rotation capacities at the ultimate design load level while ensuring that deflections and stresses and strains are within acceptable limits at the service design load level. An example continuous beam was designed by the method to have minimum cost of concrete and steel. Author

N75-32502# National Aerospace Lab., Tokyo (Japan).
STRESS INTENSITY FACTORS OF AN INTERNAL SYMMETRIC CRACK
Hiroyuki Terada and Makoto Isida Mar. 1975 14 p refs In JAPANESE; ENGLISH summary
(NAL-TR-411) Avail: NTIS HC $3.25

A rotating disk of uniform thickness containing an internal symmetric crack at any position was treated as a plane problem of elasticity. The stress function is first assumed as a series form satisfying the traction-free condition of the crack edge; for the outer boundary, a modified boundary collocation method was applied. The outer boundary is divided into several segments, and the unknown coefficients in the assumed stress function were determined by modified boundary conditions based on the resultant force along each segment, together with the single-valuedness of displacements. The stress intensity factors are calculated by the stress function obtained using a limiting procedure. Variation of the values of stress intensity factors with increasing numbers of boundary segments were examined, and the convergence seems excellent for a wide range of crack parameters. Various configurations with about forty segments were analyzed, and the results are summarized in tables and figures. Author

N75-32503*# General Dynamics/Fort Worth, Tex.
DESIGN AND FABRICATION OF COMPOSITE WING PANELS CONTAINING A PRODUCTION SPLICE
D. L. Reed Washington NASA Aug. 1975 79 p refs
(Contract NAS1-11974)
(NASA-CR-2549) Avail: NTIS HC $4.75 CSCL 20K

Bolted specimens representative of both upper and lower wing surface splices of a transport aircraft were designed and manufactured for static and random load tension and compression fatigue testing including ground-air-ground load reversals. The specimens were fabricated with graphite-epoxy composite material. Multiple tests were conducted at various load levels and the results were used as input to a statistical wearout model. The statically designed specimens performed very well under highly magnified fatigue loadings. Two large panels, one tension and compression, were fabricated for testing by NASA-LRC. Author

N75-32504# Royal Aircraft Establishment, Farnborough (England).
BEHAVIOUR OF MATERIALS UNDER MULTIAXIAL CYCLIC LOADING. PART 2: EXPERIMENTAL INVESTIGATIONS
H. Dietmann Jul. 1975 31 p refs Transl. into ENGLISH from Z. fuer Werkstofftechnik (West Ger.), v. 4, no. 6, 1973 p 322-333
(RAE-Lib-Trans-1851-Pt-2; BR48765) Avail: NTIS HC $3.75

Structures and structural components subject to multiaxial cyclic loading (drive shafts) were investigated. Several possible methods of calculation are discussed, by which the strength behavior of metallic materials under multiaxial cyclic stress conditions can be described. These are critically compared with the results of a series of experimental investigations. Author

N75-32505*# Martin Marietta Corp., Denver, Colo.
ABLATIVE HEAT SHIELD DESIGN FOR SPACE SHUTTLE Final Report, May 1972 - Aug. 1973
R. W. Seiferth Washington NASA Oct. 1975 28 p refs
(Contract NAS1-11592)
(NASA-CR-2579; MCR-73-147) Avail: NTIS HC $3.75 CSCL 22B

Ablator heat shield configuration optimization studies were conducted for the orbiter. Ablator and reusable surface insulation (RSI) trajectories for design studies were shaped to take advantage of the low conductance of ceramic RSI and high temperature capability of ablators. Comparative weights were established for the RSI system and for direct bond and mechanically attached ablator systems. Ablator system costs were determined for fabrication, installation, and refurbishment. Cost penalties were assigned for payload weight penalties, if any. The direct bond ablator is lowest in weight and cost. A mechanically attached ablator using a magnesium subpanel is highly competitive for both weight and cost. Author

N75-32506*# Del West Associates, Inc., Woodland Hills, Calif.
USERS MANUAL: MSFC CRACK GROWTH ANALYSIS COMPUTER PROGRAM
Matthew Creager Sep. 1975 69 p refs
(Contract NAS8-31101)
(NASA-CR-143923) Avail: NTIS HC $4.25 CSCL 20K

The input and output formats and options are described along with the technical approaches used within the computer program. Included are example data and problems. Author

N75-32507*# Battelle Columbus Labs., Ohio.
CONSOLIDATION OF FATIGUE AND FATIGUE-CRACK-PROPAGATION DATA FOR DESIGN USE Final Report
Richard C. Rice, Kent B. Davies, Carl E. Jaske, and Charles E. Feddersen Washington NASA Oct. 1975 76 p refs
(Contract NAS1-13358)
(NASA-CR-2586) Avail: NTIS HC $4.75 CSCL 11F

Analytical methods developed for consolidation of fatigue and fatigue-crack-propagation data for use in design of metallic aerospace structural components are evaluated. A comprehensive file of data on 2024 and 7075 aluminums, Ti-6Al-4V alloy, and 300M steel was established by obtaining information from both published literature and reports furnished by aerospace companies. Analyses are restricted to information obtained from constant-amplitude load or strain cycling of specimens in air at room temperature. Both fatigue and fatigue-crack-propagation data are analyzed on a statistical basis using a least-squares regression approach. For fatigue, an equivalent strain parameter is used to account for mean stress or stress ratio effects and is treated as the independent variable; cyclic fatigue life is considered to be the dependent variable. An effective stress-intensity factor is used to account for the effect of load ratio on fatigue-crack-propagation and treated as the independent variable. In this latter case, crack-growth rate is considered to be the dependent variable. A two term power function is used to relate equivalent strain to fatigue life, and an arc-hyperbolic-tangent function is used to relate effective stress intensity to crack-growth rate. Author

N75-32508*# Old Dominion Univ., Norfolk, Va. School of Engineering.
STUDIES OF FINITE ELEMENT ANALYSIS OF COMPOSITE MATERIAL STRUCTURES
Dale O. Douglas, Donna E. Holzmacher, Zoa C. Lane, and Earl A. Thornton Sep. 1975 135 p refs
(Grant NsG-1043)
(NASA-CR-119144; TR-75-M3) Avail: NTIS HC $5.75 CSCL 11D

Research in the area of finite element analysis is summarized. Topics discussed include finite element analysis of a picture frame shear test, BANSAP (a bandwidth reduction program for SAP IV), FEMESH (a finite element mesh generation program based on isoparametric zones), and finite element analysis of a composite bolted joint specimens. M.J.S.

N75-32509# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
ON THE FOUNDATIONS OF THE THEORY OF NON-LINEAR VISCOELASTICITY
R. S. Rivlin May 1975 28 p refs
(Contract N00014-67-A-0370-0001)
(AD-A010357; CAM-100-23) Avail: NTIS CSCL 20/12

The implications of various constitutive assumptions of the functional type with respect to material behavior are discussed. The restrictions imposed by invariance of the stress under superposed rigid rotations are introduced. The implications of continuity assumptions on the constitutive functionals with respect to representations of the latter are discussed. GRA

N75-32510# Manlabs, Inc., Cambridge, Mass.
NOISE ABATEMENT AND INTERNAL VIBRATIONAL ABSORPTION IN POTENTIAL STRUCTURAL MATERIALS Semiannual Report, 1 Sep. 1974 - 1 Mar. 1975
L. Kaufman, S. A. Kulin, and P. P. Neshe Mar. 1975 127 p refs
(Contract DAAG46-74-C-0048; ARPA Order 2555)
(AD-A010358; AMMRC-CTR-75-4) Avail: NTIS CSCL 13/3

The goal of the study is identification of alloys which can reduce vibration and noise associated with the operation of devices containing rapidly moving components. The report summarizes the progress made during the past six-month period of an investigation of methods for achieving high internal damping in potential structural materials. The results presented, obtained in studies of Ni-Ti, Cu-Al-Ni and Fe-Pt alloys, illustrate how phase transformations can be employed to achieve high vibrational damping. In addition preliminary experiments on nickel and a cobalt nickel alloy show that magnetostrictive effects can be employed to produce enhanced acoustical absorption. Moreover, the initial results obtained with cobalt-iron alloys have produced very high damping behavior. GRA

N75-32511# Stanford Research Inst., Menlo Park, Calif.
ANALYSIS OF PULSED SPOT AND FLOOD LOAD EXPERIMENTS. VOLUME 1: MULTIPLE FRACTURE OF BEAMS AND PLATES UNDER LOCALIZED IMPULSIVE LOADING Final Report, Oct. 1972 - Oct. 1973
J. D. Colton Apr. 1975 212 p refs
(Contract F29601-71-C-0103; AF Proj. 1905)
(AD-A010428; AFWL-TR-73-289-Vol-1) Avail: NTIS CSCL 20/11

An investigation was performed to determine the fracture patterns produced by localized impulsive loading on brittle beams and plates and their dependence on the intensity and area of the load. Experiments were performed on effectively infinite beams and plates loaded over a finite area with sheet explosive. The mechanisms, location, and time sequence of deformation and fracture were determined by terminal observation, high-speed framing camera photographs, and strain gages. It was found that all fractures were initiated by bending stress. In the experiments three fracture patterns in beams and two fracture patterns in plates were produced. Beam and plate response was also predicted analytically by numerically integrating the characteristic equations of Timoshenko beam theory and Mindlin plate theory. GRA

N75-32512# Iowa Univ., Iowa City. Div. of Materials Engineering.
OPTIMIZATION OF SURFACE CONTOURS FOR ELASTIC BODIES IN CONTACT Final Technical Report, Jul. 1974 - Apr. 1975 M.S. Thesis
T. S. Arora and J. S. Arora May 1975 101 p refs
(Contract DAAA09-74-M-2020)
(AD-A010405; AC-CR-75-005; TR-17) Avail: NTIS CSCL 20/11

In this report, design of surface contours of contacting elastic bodies to minimize the peak stress is considered. The initial contacting arc for the bodies is obtained by analyzing the problem through quadratic programming. The problem of minimizing the peak contact stress is then posed as a sequential linear program (LP). Convergence to the optimal solution is proved by the fact that LP solutions form a non-increasing monotone sequence which is bounded below by zero. Effectiveness of the technique is demonstrated for the problem of beam on an elastic foundation for which the peak stress is reduced considerably. GRA

N75-32513# Army Natick Labs., Mass.
A LINEAR ANALYSIS OF THE DEFORMATION OF PRES-

SURE STABILIZED BEAMS
Earl C. Steeves Jan. 1975 43 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A006493; USA-NLABS-TR-75-47-AMEL) Avail: NTIS CSCL 13/13

A linear theory for the behavior of pressure stabilized beams is derived and solutions to the resulting equations are obtained for uniform and concentrated loading for both simply supported and fixed end restraints. The concentrated load solution is in the form of a Green's function for application to more general loading situations. Results from these solutions are presented the deformation behavior and load-carrying capacity of pressure stabilized beams as a function of the pressure level, beam geometry, and material properties. Author (GRA)

N75-32514# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
LAMINATE TUBULAR SPECIMENS SUBJECTED TO BIAXIAL STRESS STATES GRAPHITE/EPOXY
R. S. Sandhu, J. B. Monfort, F. E. Hussong, E. E. Zink, and M. D. Richardson Mar. 1975 115 p refs
(AF Proj. 1467)
(AD-A010422; AFFDL-TR-73-7-Vol-2) Avail: NTIS CSCL 11/4

The response of (90 deg/plus or minus 30 deg) sub s, (0 deg/plus or minus 60 deg) sub s, (0 deg/plus or minus 45 deg) sub s and (90 deg/plus or minus 15 deg) sub s graphite epoxy (Courtald HTS fibers in fiberite-X904) laminates subjected to biaxial stress states are presented. These results are obtained using tubular specimens with t/sub D = 0.015 and L/sub D approximately 1. All specimens failed in the test section. Additionally included are the results of tests conducted on multidirectional flat specimens, both orthotropic and off-axis. The test results are compared with those predicted theoretically. There is reasonable agreement between analytical and experimental results. Author

N75-32515# Weidlinger Associates, New York.
DYNAMIC RESPONSE OF CYLINDRICAL SHELLS IN BILINEAR MEDIA- TWO DIMENSIONAL CASE
A. T. Matthews and H. H. Bleich 1 Oct. 1974 49 p
(Contract DASA01-72-C-0098; DNA Proj. NWED-QAXS)
(AD-A009955; DNA-3607Z) Avail: NTIS CSCL 19/4

The response of an infinitely long cylindrical shell buried in a bi-linear (hysteretic) material is obtained for a pressure pulse, p(theta, tau) applied to the inner boundary of the shell. The solution is obtained from a characteristic approach. This is a two-dimensional development of previous work which was axi-symmetric in nature. Comparisons of this solution with results from a finite-element computer code using the same two-dimensional configuration are given. The comparisons are good. Computations are also presented for cases with and without slip between the medium and the shell. GRA

N75-32516# Texas Transportation Inst., College Station.
EVALUATION OF FULL SCALE EXPERIMENTAL CONCRETE HIGHWAY FINISHES Final Report, Sep. 1969 - Sep. 1974
W. B. Ledbetter, A. H. Meyer, and D. E. Ballard Sep. 1974 81 p refs
(PB-242288/9; TTI-2-6-70-141-4F) Avail: NTIS HC $4.75 CSCL 13B

Eighteen experimental concrete finishes were evaluated in terms of skid resistance under standard trailer water conditions and under simulated rainfall conditions. Results indicate that (1) texture depths of 0.060 in. or greater can easily and economically be constructed with 1/8 in. metal tines spaced closer than 1/2 in. apart, (2) under normal traffic conditions all concrete textures can be expected to wear-down approximately 25 to 35 percent during the first 1/2 year and then remain relatively unchanged for a prolonged period, (3) skid measurements made under standard trailer water conditions may not be indicative of real life conditions in wet weather, (4) low skid values could be obtained in almost any rainfall in which the pavement is completely wetted, and (5) under simulated rain conditions, deep transverse texturing will result in the greatest improvement in skid values. GRA

42 GEOSCIENCES (GENERAL)

N75-32517# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY, NO. 6, 1975
4 Sep. 1975 185 p refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 3-125
(JPRS-65607) Avail: NTIS HC $7.00

Articles are presented on microclimate, agricultural meteorology, weather forecasting and climate control, hydrological forecasting, and the activities and personnel of the Soviet Hydrometeorological Service. For individual titles, see N75-32518 through N75-32531.

N75-32518 Joint Publications Research Service, Arlington, Va.
RESULTS OF THE INTERNATIONAL HYDROLOGIC DECADE c43
A. A. Sokolov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 1-10 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 3-10 (For availability see N75-32517 23-42)

Progress in the study of water resources, the improvement of methods of research, calculation and forecasting of the water regime elements and the water budget, and the contribution of Soviet scientists to the execution of the International Hydrologic Decade (IHD) program are investigated. It is noted that at the end of the IHD, the General Conference of UNESCO in November 1974 adopted a new, unlimited program for international cooperation in hydrology which is called the International Hydrologic Program (IHP), and the plan for the execution of the first phase of this program in 1975-1980 was approved. Author

N75-32519 Joint Publications Research Service, Arlington, Va.
GLOBAL MERIDIONAL SECTIONS OF THE UPPER LAYERS OF THE ATMOSPHERE c46
S. S. Gaygerov, B. P. Zaychikov, M. Ya. Kalikhman, and V. V. Fedorov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 11-20 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 11-17 (For availability see N75-32517 23-42)

Global meridional sections were analyzed which characterize the temperature and wind conditions in the stratosphere and mesosphere for different seasons. The sections are based on the data from the meridional missile network using the Soviet M-100 meteorological rocket and also on the data from the meridional missile network of North and South America which uses the American meteorological rockets. The processes on a synoptic scale in the upper layer of the atmosphere were also analyzed. The position and the spatial extent of the perturbations in the temperature and wind fields, the opposite phase nature of these disturbances in the stratosphere and mesosphere were noted. Some differences were discovered in the nature of the rearrangements of the circulation in the Northern and Southern Hemispheres. Author

N75-32520 Joint Publications Research Service, Arlington, Va.
MEASURING THE AEROSOL CHARACTERISTICS AND DENSITY OF THE ATMOSPHERE BY LASER RADAR c48
V. M. Zakharov, O. K. Kostko, and V. S. Portasov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 21-28 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 18-23 (For availability see N75-32517 23-42)

The experimental results are presented from laser sounding of the atmosphere on wavelengths of 530, 694.3 and 1060 nm. The inverse (general and molecular) scattering profiles were obtained. The density was calculated by the molecular scattering profile of laser radiation in the atmosphere. This value of the density was compared with the density from radiosounding measurements. A study was made of methods of processing the data from the laser sounding - the methods of approximation and the two-wave method. Conclusions are drawn regarding the spectral dependence of the aerosol dispersion coefficient. Author

N75-32521 Joint Publications Research Service, Arlington, Va.
CONDITIONS OF DEVELOPMENT OF CONVECTIVE CLOUDS AND PRECIPITATION IN THE TRADEWIND AND EQUATORIAL ZONES OF THE ATLANTIC OCEAN (ACCORDING TO THE MATERIALS OF THE VOLNA SCIENTIFIC RESEARCH WEATHER SHIP) c47
S. I. Ponomarenko *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 29-39 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 24-31 (For availability see N75-32517 23-42)

The positions of the lower and upper valleys of the tradewind inversion and convective clouds, the temperature discontinuity at the inversion boundaries, and the temperature at the upper boundary of the tradewind clouds in the northern and southern parts of the Atlantic Ocean were calculated. The mean values of the convection parameters on days with showers and without precipitation were determined for the equatorial zone of the Atlantic Ocean. The singularity of the stratification in the upper troposphere unfavorable to the development of thunderstorms in the equatorial zone of the Atlantic Ocean was noted. Author

N75-32522 Joint Publications Research Service, Arlington, Va.
RADIOSOUNDING DATA AS A MEANS OF DISCOVERING CLOUD LAYERS c47
Ye. N. Arabey *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 40-46 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 32-37 (For availability see N75-32517 23-42)

A procedure is proposed for graphical discovery of cloud layers. The form and amount of precipitation with respect to temperature and dewpoint deficit is determined from radiosounding data. By using the obtained relations the characteristics of the cloud layers in the tropical zone of the Indian Ocean are determined. Author

N75-32523 Joint Publications Research Service, Arlington, Va.
EFFECT OF MOSCOW ON THE INTEGRAL TRANSPARENCY OF THE ATMOSPHERE c46
G. M. Abakumova and Z. P. Semenova *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 47-57 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 38-45 (For availability see N75-32517 23-42)

The time variability is studied of the turbidity factor and its components for a 19-year period using data from the Meteorological Observatory of Moscow State University and the station imeni S. I. Nebol'sin located 40 km southwest of Moscow. An estimate is made of the differences between the transparency of the atmosphere in Moscow and in the suburbs by months and for different wind directions. Author

N75-32524 Joint Publications Research Service, Arlington, Va.
ESTIMATING THE HEAT BALANCE ON THE SURFACE OF THE NORTHWESTERN PART OF THE PACIFIC OCEAN AND ITS RELATION TO CURRENTS c48
L. Ye. Veselova and V. V. Pokudov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 58-64 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 46-51 (For availability see N75-32517 23-42)

The peculiarities of the spatial distribution of the heat balance and the components on the surface of the northwestern part of the Pacific Ocean in the winter of 1971/1972 are described. It was established that the greatest values of the negative balance and the maximum heat transfer to the atmosphere are observed in the vicinity of the northern branch of Kurosio. The minimum heat losses and the least negative balance are noted north of 41 deg north latitude. Author

N75-32525 Joint Publications Research Service, Arlington, Va.
SEMIANNUAL FLUCTUATIONS OF THE HYDROLOGIC ELEMENTS IN THE OCEAN c48
V. F. Sukhovey *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 65-75 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 52-60 (For availability see N75-32517 23-42)

The semiannual variations are studied of the current velocity and water temperature in the northern part of the Atlantic Ocean. The phases and amplitudes of the semiannual fluctuations are presented. It is demonstrated that the semiannual fluctuations of the permanent current velocities and the level slopes occur under the effect of the corresponding changes in the wind system connected with redistribution of the air over the oceans and continents which take place twice a year. The semiannual solar tide does not play a significant role in these fluctuations. The presence of the semiannual wave in the water temperature fluctuations is explained by the asymmetric annual temperature curve caused by the peculiarities of the heating and cooling processes of the water in the temperature and high latitudes. Author

N75-32526 Joint Publications Research Service, Arlington, Va.
A SEMIEMPIRICAL METHOD OF DESCRIBING THE MECHANISM OF VERTICAL TURBULENT MIXING c34
O. V. Kazakov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 76-84 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 61-67 (For availability see N75-32517 23-42)

On the basis of the experimental measurements of the level slope and the velocity profiles in artificial channels of the Volga River estuary an expression was obtained which relates the coefficient of vertical turbulent viscosity k sub z to the parameters of the mean movement: the mean local velocity and its vertical derivatives. The conclusion is drawn that k sub z is most closely interrelated to the square of the mean velocity. This conclusion and a number of other semiempirical expressions agree well with the theory of steady state turbulent currents. The applicability of the expression obtained for k sub z to the description of the turbulence in the drift type gradient currents of the shallow sea is checked. The calculation results and a qualitative discussion of them are presented. Author

N75-32527 Joint Publications Research Service, Arlington, Va.
STUDY OF THE THERMAL RADIOWAVELENGTH EMISSION OF THE WATER SURFACE COVERED WITH OIL FILM c45
A. A. Glotov, D. T. Matveyev, V. G. Mirovskiy, M. D. Rayev, V. Yu. Rayzer, I. A. Troitskiy, Ye. A. Sharkov, and V. S. Etkin *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 115-119 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 90-93 (For availability see N75-32517 23-42)

Results are discussed from measuring the radio brightness temperature of a smooth wavy surface covered by a solar oil and kerosene film using a highly sensitive two-centimeter band radiometer. A comparison of the experimental and calculated values of the radio brightness temperature permitted unique determination of the film thickness and estimation of the unknown dielectric parameters of the solar oil and kerosene. Author

N75-32528 Joint Publications Research Service, Arlington, Va.
ATMOSPHERIC PRECIPITATION AND GROUNDWATER LEVEL ABOVE ALUPKI (SOUTH COAST OF CRIMEA) c47
V. Ye. Rudakov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 124-127 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 95-97 (For availability see N75-32517 23-42)

Results are presented of a study establishing the quantitative dependence of the ground water level fluctuations on the fluctuations of the amount of atmospheric precipitation. Author

N75-32529 Joint Publications Research Service, Arlington, Va.
PHENOMENON OF COHERENT REFLECTION OF PULSED RADIO SIGNALS FROM A WAVY SEA SURFACE c32
I. V. Kireyev and A. V. Svechnikov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 128-133 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 97-100 (For availability see N75-32517 23-42)

A physical model is studied of the reflection of a radar signal from a ship's navigation radar from the wavy sea surface. An explanation is given of the absence of the dependence of the mean pulsation frequency of the echo envelope as a function of the speed of movement of the radar antenna with respect to the sea surface. The expression obtained for the mean pulsation frequency of the echo is found in accordance with the data of the experimental studies. Author

N75-32530 Joint Publications Research Service, Arlington, Va.
RESULTS OF COMPARING STANDARD METEOROLOGICAL EQUIPMENT DURING THE GATE-73 EXPEDITION **c47**
D. P. Bespalov and R. G. Timanovskaya *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 101-106 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 101-106 (For availability see N75-32517 23-42)

The real errors in determining the basic meteorological elements from ships under open sea conditions are estimated. The results are obtained when generalizing the data from the meteorological observations during the GATE-73 expedition with the participation of four ships of different design. Author

N75-32531 Joint Publications Research Service, Arlington, Va.
PHLOROGLUCINOL, SOME OF ITS PROPERTIES AND THE POSSIBILITIES OF ITS APPLICATION FOR MODIFYING SUPERCOOLED CLOUDS **c47**
V. V. Piotrovich *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 152-158 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 111-114 (For availability see N75-32517 23-42)

The results are presented from studies of the ice forming capacity of an organic material: floroglucinin. Laboratory experiments and experiments in its application to cause precipitation from supercooled clouds are described. Conclusions are drawn that fluoroglucinol will become active only after loss of the water of crystallization which is achieved by sublimation or dessication. Author

N75-32532# European Space Research Organization, Paris (France).
EUROPEAN SOUNDING ROCKET AND SCIENTIFIC BALLOON ACTIVITY AT HIGH LATITUDES, WITH EMPHASIS ON THE INTERNATIONAL MAGNETOSPHERIC STUDY (IMS)
Feb. 1975 346 p refs Proc. of a Symp. held at Oerenaes Slott, Swed., 9-12 Sep. 1974 Original contains color illustrations
(ESRO-SP-107) Avail: NTIS HC $9.50

Selected papers in the field of European national sounding rockets and balloon programs related to the International Magnetospheric Study as well as satellite-borne, rocket-borne, balloon-borne, and ground equipment for auroral spectroscopy, upper atmospheric physics, and ionospherics are presented. For individual titles, see N75-32533 through N75-32569.

N75-32533 Centre National d'Etudes Spatiales, Paris (France).
FRENCH NATIONAL SOUNDING-ROCKET AND BALLOON PROGRAMME RELATED TO THE IMS **c15**
M. Aubert *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 5-6 (For availability see N75-32532 23-42)

Programs outlined include the study of polar and auroral magnetosphere convection, wave measurements of rocket experiments, and electric field and X-ray flux measurements by balloon experiments. ESA

N75-32534 Science Research Council, Slough (England).
BRITISH SOUNDING-ROCKET PROGRAMME AND THE ESRANGE SPECIAL PROJECT **c15**
G. W. Eastwood *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 7-9 refs (For availability see N75-32532 23-42)

Participation in the investigation of auroral substorms is reported. The four Skylark and fourteen Petrel launchings at Andoya during the 1973 U.K. high-latitude rocket campaign are tabulated. ESA

N75-32535 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
GERMAN NATIONAL SCIENTIFIC BALLOON AND SOUNDING ROCKET PROGRAMME **c15**
D. Joneleit *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 11-17 (For availability see N75-32532 23-42)

Current and planned balloon activities are tabulated. Scientific institutes involved in research with balloons or sounding rockets are compiled. Sounding rockets in the German space program in the fields of astronomy, aeronomy, and magnetosphere are tabulated. Future prospects are given. ESA

N75-32536 Austrian Space Agency, Vienna.
AUSTRIA'S SOUNDING ROCKET AND SCIENTIFIC BALLOON PROGRAMME **c15**
J. Ortner *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 25-26 (For availability see N75-32532 23-42)

Participation in the International Magnetospheric Study (IMS) in the field of balloon and rocket sounding is reported. Other rocket projects not related to the IMS are briefly outlined. ESA

N75-32537 Swedish Space Corp., Stockholm.
SWEDISH SOUNDING ROCKET PROGRAMME FOR 1974-1978 **c15**
P. Nobinder *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 27-29 (For availability see N75-32532 23-42)

The program is presented in tabulated form. The data include the institutes, experimental equipment, date of launchings, and types of vehicle. ESA

N75-32538 Denver Univ., Colo.
THE INTERNATIONAL MAGNETOSPHERIC STUDY 1976 - 1978 **c15**
J. G. Roederer *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 31-33 (For availability see N75-32532 23-42)

Well defined stages requiring coordinated observations from spacecraft, ground-based facilities, aircraft, balloons, and research rockets are presented. They include the identification of relevant satellite programs taking into account the long lead times involved, the identification of physical problems, and scientific questions that could eventually become the target of a cooperative program such as the International Magnetospheric Study. ESA

N75-32539 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE CURRENT PROGRAMME OF THE MOBILE RAKETEN-BASIS **c14**
R. Klein *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 35-42 (For availability see N75-32532 23-42)

The three different programs which will use the mobile launching base are described. They include the Huelva 3 campaign aimed at additional data on the X-ray sources in the Crab nebula by the moon occultation technique; the Greenland 1 campaign aimed at launching three Black Brant 4a rockets, one Nike Tomahawk, and four Petrel 2 rockets to explore the region in ionosphere and the magnetosphere; and the Woomera 1 campaign to launch the ESRO S98 payload with a Goldfinch-boosted Raven 6. ESA

N75-32540 Uppsala Ionospheric Observatory (Sweden).
THE SOUNDING ROCKET PROGRAMME DURING THE IMS AT UPPSALA IONOSPHERIC OBSERVATORY **c46**
B. Holback *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 43-45 refs (For availability see N75-32532 23-42)

The program at the Uppsala Ionospheric Observatory includes measurements of parameters in the lower ionosphere important for modelling, and investigations of vertical coupling between the ionosphere and the magnetosphere along the geomagnetic field lines. E and F-region experiments to investigate electron and ion densities and auroral luminosity in the disturbed ionosphere are also included. ESA

N75-32541 Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).

WAVES AND WAVE-PARTICLE INTERACTIONS IN THE MAGNETOSPHERE: A REVIEW c46

R. Gendrin *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 47-83 refs (For availability see N75-32532 23-42)

Recent space observations of waves, both electromagnetic and electrostatic, are reviewed and the role they play in the dynamics of magnetospheric particles is stressed. Wave-particle interactions (WPI) in the exo-and intra-plasmaspheric media depend on the exact process of particle injection under the influence of magnetospheric electric fields and on spatial distribution of the cold plasma particles; these two aspects of the problem are studied to some extent. The concepts of optimum cold plasma density, critical energy, limiting flux, marginal stability, and steady-state equilibrium are critically discussed. The nonlinear aspects - both experimental and theoretical - of WPI's are reviewed and a special section is devoted to active experiments in space. An attempt is made to outline which kind of experiments could be conducted at high-latitudes, in conjunction with IMS spacecraft, to arrive at a better understanding of magnetospheric processes involving waves and particles. Author (ESA)

N75-32542 Appleton Lab., Slough (England).

PLASMAS OF THE MAGNETOSPHERE c46

D. A. Bryant and A. D. Johnstone (Univ. Coll., London) *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 85-102 refs (For availability see N75-32532 23-42)

The various plasmas that have been identified within the magnetosphere's six different regions such as the solar wind, the magnetotail, the plasmasphere, the plasma sheet, the distant tail, and the ionosphere are examined and the various boundaries identified. ESA

N75-32543* California Univ., La Jolla.

PLASMA CLOUDS AND AURORAL ARCS c46

S. DeForest and R. Judge *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 103-123 refs (For availability see N75-32532 23-42)
(Contracts NAS5-10364; NAS5-21055; Grant NGL-05-005-007)

Correlation techniques for magnetospheric observations of various types by instrumented spacecraft in synchronous orbit are discussed. Emphasis is placed on ideas for possible use in studies with GEOS satellite during the International Magnetospheric Study, and comparison of auroral and magnetospheric plasma features are considered. Correlation between ATS-5 particle detector measurements with ground based measurement and other spacecraft such as Explorer 45 is described. Observations from ATS-6 instrument are briefly mentioned. ESA

N75-32544 Alberta Univ., Edmonton. Inst. of Earth and Planetary Physics.

STUDIES OF MAGNETIC SUBSTORMS USING GROUND-BASED, BALLOON, ROCKET AND SATELLITE OBSERVATIONS c46

G. Rostoker *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 125-140 refs Sponsored by Can. NRC (For availability see N75-32532 23-42)

The present understanding of the configuration of particle and fields in the region of the auroral oval is discussed. The conflicts and disagreements which surround some of these concepts are presented. The performances and weaknesses of the various methods of monitoring substorm activity are discussed. They include ground-based measuring instruments such as the magnetometer, all-sky camera, auroral photometer, riometer, incoherent scatter radar, balloon-borne detectors (X-ray detectors, electric field detectors) and satellite-borne instruments. Some suggestions are made for ways of resolving the existing misunderstandings in the field of substorm morphology in the light of anticipated research activity during the International Magnetospheric Study. ESA

N75-32545 European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.

SITUATION REPORT ON GEOS c18

K. Knott *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 143-148 (For availability see N75-32532 23-42)

The new GEOS configuration is described together with the general features. This satellite will be launched from Eastern Test Range on a Thor-Delta 2914 launcher at the end of August 1976. The mission aims (ULF observations) are outlined. ESA

N75-32546 European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.

GEOS FIELD AND WAVE EXPERIMENTS c18

A. Pedersen *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 149-157 (For availability see N75-32532 23-42)

The satellite observation program foreseen by the scientific groups associated with field and wave experiments on GEOS is outlined. Technical details of the experiments are given only insofar as they are important for the understanding of the scientific observations, emphasis being placed on explaining the type of data to be obtained, the sensitivities to various magnetospheric parameters, and the resolutions in the time and frequency domains. Experimental equipment include the S-329 electron gun, S-331 fluxgate magnetometer, S-300 electric and magnetic field sensors, and plasma resonance experiment. ESA

N75-32547 University Coll., London (England). Mullard Space Science Lab.

GEOS PARTICLE EXPERIMENTS c18

G. L. Wrenn *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 159-165 refs (For availability see N75-32532 23-42)

The four particle experiments onboard the European geostationary magnetospheric satellite GEOS which will be launched in 1976 as the reference spacecraft for the International Magnetospheric Study are described. Characteristics of the instruments which relate to the coordinated aspects of the mission and to the use of the particle data together with the GEOS wave and field measurements are emphasized. ESA

N75-32548 European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.

OUTLINE AND PROGRESS OF THE INTERNATIONAL SUN-EARTH EXPLORER PROJECT c18

A. C. Durney *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 167-174 (For availability see N75-32532 23-42)

The international ESA/NASA Sun-Earth Explorer project (ISEE project) which is to complement GEOS measurements and make a contribution to the International Magnetospheric Study is briefly described. The most interesting features for this mission to be studied are the bow shock and the magnetosheath with a view of investigating wave-particle interaction in this region. The orbits of ISEE A, B, C spacecraft are analyzed as well as the experimental payloads. ESA

N75-32549 European Space Operations Center, Darmstadt (West Germany).

DATA HANDLING DURING THE IMS c46

K. G. Lenhart *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 175-180 ref (For availability see N75-32532 23-42)

The Satellite Situation Center (SSC) aims and the data handling for the GEOS satellite, which will be the reference spacecraft during the International Magnetospheric Study, are described. The SSC and the product of the GEOS data processing system should provide scientists with information in identifying interesting data and periods for coordinated studies. ESA

N75-32550 Technische Hochschule, Graz (Austria). Space Research Inst. of the Austrian Academy of Sciences.

AURORAL ZONE X-RAY MEASUREMENTS WITH BALLOON-BORNE INSTRUMENTS AS A PART OF THE GEOS PROJECT c46

G. Kremser *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 181-186 refs (For availability see N75-32532 23-42)

The importance of the auroral-zone X-ray measurements is discussed. Emphasis is given to special investigations using simultaneous X-ray measurements and particle and field data from a geostationary satellite. Problems involved in balloon programs during the GEOS mission are also discussed.

Author (ESA)

N75-32551 Bergen Univ. (Norway). Dept. of Physics.

EXPERIENCES WITH TELEMETRY AND LOCALISATION OF BALLOONS DRIFTING FROM SCANDINAVIA TO GREENLAND, WITH SUGGESTIONS FOR CO-ORDINATED CAMPAIGNS DURING THE GEOS PERIOD c46

H. Trefall *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 187-193 refs (For availability see N75-32532 23-42)

The long-duration flight capabilities of modern stratospheric balloons, coupled with their westward drift in the summer, make it possible to perform balloon recordings over the region from Scandinavia to Greenland with launchings from Scandinavian stations only, the VHF radio range of a balloon-borne transmitter being sufficient to cover the region mentioned from land-based telemetry stations only. Furthermore, balloon positions all the way from Scandinavia to Greenland can now be determined by means of the CONSOL navigation system. This allows the coordination of balloon recordings and GEOS satellite measurements even when the satellite is located on a field line that comes down between Scandinavia and Greenland. In particular, the geomagnetically conjugate point with the satellite is close to the geomagnetic equator falls in the sea between Norway and Iceland, but the surrounding area can easily be well covered by balloon measurements if they are well coordinated and conducted on a sufficiently large scale. Author (ESA)

N75-32552 Bern Univ. (Switzerland).

PROPOSAL FOR A NEW TYPE OF ION TRACER EXPERIMENT USING AN ION MASS SPECTROMETER AT THE GEOSTATIONARY ORBIT c46

D. T. Young *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 195-200 refs (For availability see N75-32532 23-42)
(Grant SNSF 2.080.73)

A new concept in ion tracer experiments in the magnetosphere is proposed. Barium or lithium ions injected at the foot of the 6.6 R sub E field line by conventional shaped-charge release might be detectable in the equatorial plane by a mass-energy spectrometer of the type to be flown on the GEOS satellite. Comparison of optical and mass-spectrometric detection techniques shows the latter to be more sensitive in some cases by several orders of magnitude. An analysis shows Coulomb collisions to be insufficient for scattering the necessary fraction of beam ions into the pitch-angle viewing range of the detector. The GEOS spectrometer is shown to be sensitive enough to detect isotropic tracer ion densities of 0.0001 to approximately 0.00001/cucm depending on ion species and energy.

Author (ESA)

N75-32553 Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).

SOUNDING ROCKET EXPERIMENTS FOR DETAILED STUDIES OF MAGNETOSPHERIC SUBSTORM PHENOMENA c46

W. Stuedemann and K. Wilhelm *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 201-204 (For availability see N75-32532 23-42)

The scientific objective of the earth's magnetosphere sounding-rocket program to contribute to the knowledge of physical processes operating during a magnetospheric substorm is described. The experiments are listed and the launch conditions described. ESA

N75-32554 Appleton Lab., Slough (England).

PROPOSED UK HIGH-LATITUDE ROCKET CAMPAIGN IN LATE 1976/EARLY 1977 c46

G. R. Thomas and D. A. Bryant *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 205-210 refs (For availability see N75-32532 23-42)

The second major U.K. high-latitude rocket campaign is scheduled at Andoya. The proposed experiments provide a comprehensive set of measurements of high-latitude phenomena and include studies of the sources and acceleration of auroral particles, the stability of plasma flow, wave-particle interactions, and the response of the atmosphere and ionosphere to enhanced geomagnetic activity. These experiments require co-ordinated launchings of high-altitude (740 to 950 km) and small, medium-altitude (320 to 370 km) rockets. The provisional campaign plan includes four Skylark 12's (with Skylark 11 as a possible substitute), one Skylark 7 (with Skylark 6 as a possible substitute), and five Fulmars (with Skylark 10A as a possible substitute). Some of the experiments require simultaneous measurements by GEOS in the European sector (early 1977), but the remainder could be carried out in late 1976.

Author (ESA)

N75-32555 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

A SURVEY OF ATTITUDE-CONTROL AND RECOVERY SYSTEMS FOR THE CURRENT GERMAN SOUNDING ROCKET PROGRAMME c54

E. Krieg *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 211-215 (For availability see N75-32532 23-42)

The attitude control systems and recovery systems are analyzed. The Astro 7 (ESRO S-108 experiment) comprising a UV polychromator and two photometers, one for the visible, and the other for the infrared spectrum, is described as well as its associated electronic and pneumatic systems. ESA

N75-32556 Uppsala Ionospheric Observatory (Sweden).

PROPOSED RELEASE EXPERIMENT TO STUDY IONOSPHERIC-MAGNETOSPHERIC COUPLING c46

G. Holmgren *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 217-220 refs (For availability see N75-32532 23-42)

Release experiments in the F-region are reviewed. Future experiments to establish a magnetic field line connection between the ion cloud and the instruments measuring ambient perturbations are suggested. ESA

N75-32557 Liege Univ. (Belgium). Inst. d'Astrophysique.

A ROCKET-BORNE SPECTROMETER FOR HIGH-RESOLUTION STUDIES OF ATMOSPHERIC EMISSIONS c46

M. Henrist, R. Duysinx, J. Jamar, and J. P. Macau *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Empahsis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 221-224 refs (For availability see N75-32532 23-42)

A spectrometer to be used onboard a sounding rocket to study the ultraviolet spectrum of polar aurorae is described, including the optical layout, detection system, and the spectrograph characteristics. It is concluded that a spectrograph of this type linked with an image tube and a real-time computer would constitute a valuable instrument for ground-based observations of the International Magnetospheric Study. ESA

N75-32558 Southampton Univ. (England). Dept. of Physics.

DETERMINATION BY TRIANGULATION OF THE REGIONS WHERE WHISTLERS EMERGE FROM THE IONOSPHERE c32

M. J. Rycroft, M. J. Jarvis, and H. J. Strangeways *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study

(IMS) Feb. 1975 p 225-232 refs (For availability see N75-32532 23-42)

Observations made on 10 July 1972, using four goniometer (direction-finding) VLF receivers in eastern Canada, were analyzed. The regions where multicomponent, two-hop whistlers emerge from the ionosphere into the earth-ionosphere waveguide were found by triangulation. For recordings made before the total solar eclipse, the L-values of the whistler exit points determined by triangulation are consistently lower than those determined from their nose frequencies. This discrepancy cannot be fully accounted for by the effect of the ring current. To explain it, it is postulated that on this occasion the electron-density trough in the topside ionosphere lies at a lower L-value than that of the plasmapause. Ray-tracing studies show that, on the high-latitude side of the trough, the waves are refracted to higher L-values before becoming ducted. Thus the multigoniometer technique is proving to be a powerful method for studying both temporal and spatial variations of the ionospheric and magnetospheric plasmas.

Author (ESA)

N75-32559 Oslo Univ. (Norway). Inst. of Cosmic Physics.
ROCKET OBSERVATIONS OF SMALL-SCALE IRREGULARITIES IN THE AURORAL F-REGION **c32**

T. E. Moe, A. Egeland, J. A. Holtet, D. S. Evans (NOAA, Boulder, Colo.), and W. Ecklund (NOAA, Boulder, Colo.) *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 233-237 refs (For availability see N75-32532 23-42)

Nike-Tomahawk payload observations on the ac electric field recorded in ten different frequency bands during the 16 January 1973 launching from Andoya at an altitude of 280 km are reported. The main experimental findings are: intense structured emissions are observed within narrow regions closely connected with the boundary or discrete auroral forms; these emissions are only detected below the electron gyro frequency. A strong signal is recorded on the channel centered at 600 kHz but no enhanced emissions are observed in the frequency range 960 to 1120 kHz or above; the channels centered at 200 kHz and above see these irregularities first, and at approximately the same time. There is a marked time delay (approximately 2.5 s) to spectrometer channel 1 (center frequency 55 Hz, bandwidth 20 to 150 Hz) and spectrometer channel 2 (center frequency 200 kHz, bandwidth 65 to 150 kHz). Some explanations are proposed for these time delays; however, it is concluded that further ray tracing studies are needed.

ESA

N75-32560 Technische Hochschule, Graz (Austria). Space Research Inst. of the Austrian Academy of Sciences.
ION PRODUCTION AND THE EFFECTIVE ELECTRON LOSS COEFFICIENT IN A RELATIVISTIC ELECTRON PRECIPITATION (REP) EVENT **c46**

T. A. Jacobsen, M. Friedrich, and W. Riedler *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 239-246 refs (For availability see N75-32532 23-42) (Grant ACSR-1448)

The precipitation of low-energy electrons and the density of thermal electrons were measured simultaneously in a relativistic electron precipitation event on a daylight rocket flight from Andoya, Norway (L = 6). The electron-density profile was derived from measurement of the Faraday rotation and the differential absorption at three frequencies: 2.200, 3.883, and 7.835 MHz. The ion production and the effective loss coefficient are deduced, using data previously published. An interpretation of the measurements in terms of a generalized two-ion model is presented.

Author (ESA)

N75-32561 Norwegian Defence Research Establishment, Kjeller.
RESONANCES AND NONLINEARITIES OBSERVED IN A WAVE EXPERIMENT ON A MOTHER-DAUGHTER ROCKET **c46**

K. Folkestad, J. Troeim, and J. Bording (Trondheim Univ.) *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 247-254 refs Sponsored partly by Roy. Norweg. Council for Sci. and Ind. Res. (For availability see N75-32532 23-42)

Results of a wave-propagation experiment conducted in the ionospheric F-region are discussed. The swept-frequency HF experiment with transmitter and receiver both located in the ionospheric F-region less than 1 to 2 km apart is described. Theoretically derived dispersion relations were used to identify the main characteristics of the data. The analysis emphasizes the importance of cone resonances in establishing transmission between the two stations considered, in particular, the whistler-cone resonance is persistently observed. The weak turbulence model appears to be a potential driving mechanism for some marked nonlinearities in the observed signals.

Author (ESA)

N75-32562 University Coll., London (England). Mullard Space Science Lab.
TIME-DEPENDENT EFFECTS OF A PARALLEL ELECTRIC FIELD **c46**

A. D. Johnstone *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 255-260 refs Original contains color illustrations (For availability see N75-32532 23-42)

Model calculations to find an explanation for some observations of precipitating electrons made by a sounding rocket are presented. Many of the features of the event observed by the rocket indicated that its cause was an electric field parallel to the magnetic field lines. The characteristics of this model include time-dependent effects, electric field distribution over the entire length of the field line from the atmosphere to the equator, two nonadiabatic effects inclusion in the model as backscattering with the backscattered flux proportional in intensity to the precipitating flux, and pitch-angle diffusion near the equator.

ESA

N75-32563 Appleton Lab., Slough (England).
ENERGY AND ANGULAR DISTRIBUTION OF AURORAL PARTICLES RESULTING FROM TIME-VARYING ACCELERATION **c46**

D. S. Hall and D. A. Bryant *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 261-266 refs (For availability see N75-32532 23-42)

A model is presented with a static electric field parallel to the magnetic field lines, and time-varying acceleration responsible for the auroral precipitation. The energy spectra and angular distribution of the auroral particles which predicted using this model are discussed and compared to observations of field aligned electrons made from the sounding rocket launched from Kiruna, Sweden, on 22 November 1971 at 135 km altitude during the expansion phase of an auroral substorm.

ESA

N75-32564 Kiruna Geophysical Inst. (Sweden).
COMPARISON OF LIGHT EMISSIONS AND AURORAL PARTICLES IN A POST-BREAK-UP AURORA **c46**

R. Lundin and L. E. Andersson *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 267-277 Sponsored in part by Swed. Nat. Sci. Res. Council and Swed. Board for Tech. Develop. (For availability see N75-32532 23-42)

Auroral particle measurements made on a rocket, launched from Esrange on 27 October 1970 at 20.34.22 UT, in the recovery phase of a substorm, are compared with ground-based photometer observations. For most of the flight the photometer signals at 3914, 4278, and 5577 A and the electron fluxes measured by the rocket-borne particle detectors showed exponentially decreasing intensities, suggesting diffusion of newly injected particles on closed geomagnetic field lines. The pitch-angle distribution of electrons in the energy range 1 to 12 keV was predominantly isotropic over the upper hemisphere indicating that electrons were strongly scattered into the loss cone. Electrons of higher energies (greater than 55 keV) were only sampled in the pitch-angle range approximately 70 deg to approximately 110 deg, i.e. more or less outside the loss cone. Two burst-like events with field-aligned electron pitch-angle distributions are discussed. According to the phase-density spectrums obtained, the first event could be explained by a field-aligned potential drop.

Author (ESA)

N75-32565 Naval Research Lab., Washington, D.C. Space Science Div.

THE ARIES CONTROLLED SOUNDING ROCKET c15
R. D. Arritt and C. S. Dugan (Space Vector Corp., Northridge, Calif.) *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 279-294 (For availability see N75-32532 23-42)

Background and objectives of the Aries automatic controlled sounding rocket using the second stage of Minuteman 1B motor are presented. The practical payload capability of the Aries ranges from 400 to 2200 lb; altitudes for these payloads range from 535.8 to 254.2 km with related viewing time above 91440 m of 13.4 to 6.2 min. The first scientific payload onboard Aries 1 will be launched on 27 December 1974 from White Sands Missile Range to observe the Crab occultation. The International Magnetospheric Study is another program committed to Aries; this launch is scheduled for early 1975. Principal features such as payload weight, volume, accommodation, launch altitude and thrust provision, etc., as well as vehicle elements and testing are presented. ESA

N75-32566 Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
PROJECT PORCUPINE: A STEP TOWARDS UNDERSTANDING THE AURORA c15
G. Haerendel and R. Klett (Ingenieurbuero Klett) *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 295-230 (For availability see N75-32532 23-42)

Porcupine, the German sounding rocket project aimed at studying the coupling between the earth's magnetosphere and ionosphere, is presented. The launching of four Aries sounding rockets from Esrange, Sweden, over Norway into the Arctic Ocean is planned for February/March 1976 and February/March 1977. The rockets will be instrumented with particle and field detectors and active wave and plasma injection experiments. The immediate goal is a close comparison of the sounding rocket data with data from the geostationary satellites ATS 6 and GEOS. ESA

N75-32567 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DFVLR ACTIVITIES FOR THE IMS-ARIES PROJECT c15
H. Bader *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 301-305 refs (For availability see N75-32532 23-42)

Proposed major activities for the International Magnetospheric Study/Aries project are outlined. They are concerned mainly with supporting the preparation of the Aries vehicle and the Safety Operation System. ESA

N75-32568 Royal Norwegian Council for Scientific and Industrial Research, Blindern. Space Activity Div.
ANDOEYA ROCKET RANGE c14
R. Bjurstroem and A. Gundersen *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 317-322 (For availability see N75-32532 23-42)

The Andoya rocket range hazard areas, sites, instrumentation, and balloon facilities are outlined. ESA

N75-32569 Swedish Space Corp., Kiruna.
DEVELOPMENT AND PROVISION OF TECHNICAL EQUIPMENT AT ESRANGE DURING THE PERIOD JULY 1972 TO DECEMBER 1973 c14
B. Eriksson *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 323-331 (For availability see N75-32532 23-42)

The Esrange sounding-rocket range is discussed which is situated in Northern Sweden inside the Arctic Circle and is used mainly for auroral studies. It is equipped with launchers for many different types of rockets. Its technical facilities, instrumentation including telemetry equipment, scientific equipment, and support facilities are briefly described. ESA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N75-32570*+ National Aeronautics and Space Administration, Washington, D.C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 3
May 1975 128 p refs
(NASA-SP-7041(03)) Avail: NTIS HC $4.00 CSCL 05B

This bibliography lists 472 reports, articles, and other documents introduced into the NASA scientific and technical information system between July 1974 and September 1974. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory, natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, oceanography and marine resources, hydrology and water management, data processing, and distribution systems, instrumentation and sensors, and economic analysis. Author

N75-32571*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG NO. N-36
31 Aug. 1975 126 p
(NASA-TM-X-72512) Avail: NTIS HC $5.75 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska, and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross reference defining the beginning and ending dates for LANDSAT cycles. Author

N75-32572*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: US STANDARD CATALOG NO. U-36
31 Aug. 1975 80 p
(NASA-TM-X-72513) Avail: NTIS CSCL 05B

Information regarding the availability of LANDSAT imagery which has been processed and input to the data files during the referenced month is presented. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii as well as that from adjacent areas. Author

N75-32573*# Texas A&M Univ., College Station. Dept. of Mathematics.
IMAGE 100 PROCEDURES MANUAL DEVELOPMENT: APPLICATIONS SYSTEM LIBRARY DEFINITION AND IMAGE 100 SOFTWARE DEFINITION Final Report
L. F. Guseman, Jr. and Henry P. Decell, Jr. 1975 256 p refs
Prepared in cooperation with Houston Univ., Texas
(Contracts NAS9-14556; NAS9-14557)
(NASA-CR-144442) Avail: NTIS HC $8.50 CSCL 05B

An outline for an Image 100 procedures manual for Earth Resources Program image analysis was developed which sets forth guidelines that provide a basis for the preparation and updating of an Image 100 Procedures Manual. The scope of the outline was limited to definition of general features of a procedures manual together with special features of an interactive system. Computer programs were identified which should be implemented as part of an applications oriented library for the system. Author

N75-32574*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOLOGICAL MAPPING IN NORTHWESTERN SAUDI ARABIA USING LANDSAT MULTISPECTRAL TECHNIQUES
H. W. Blodget, G. F. Brown (Geological Survey, Reston, Va.), and J. G. Moik (Computer Sciences Corp., Silver Spring, Md.)

Aug. 1975 26 p refs Submitted for publication
(NASA-TM-X-70961; X-923-75-206) Avail: NTIS HC $3.75 CSCL 08B

Various computer enhancement and data extraction systems using LANDSAT data were assessed and used to complement a continuing geologic mapping program. Interactive digital classification techniques using both the parallel-piped and maximum-likelihood statistical approaches achieve very limited success in areas of highly dissected terrain. Computer enhanced imagery developed by color compositing stretched MSS ratio data was constructed for a test site in northwestern Saudi Arabia. Initial results indicate that several igneous and sedimentary rock types can be discriminated. Author

N75-32575*# Lockheed Electronics Co., Plainfield, N.J.
CROP IDENTIFICATION TECHNOLOGY ASSESSMENT FOR REMOTE SENSING. (CITARS) VOLUME 9: STATISTICAL ANALYSIS OF RESULTS
Barbara J. Davis and Alan H. Feiveson Sep. 1975 113 p
(Contract NAS9-12200)
(NASA-CR-144458; LEC-4326G-Vol-9; JSC-09392) Avail: NTIS HC $5.25 CSCL 02C

Results are presented of CITARS data processing in raw form. Tables of descriptive statistics are given along with descriptions and results of inferential analyses. The inferential results are organized by questions which CITARS was designed to answer. Author

N75-32576# Massachusetts Inst. of Tech., Cambridge.
OIL IN THE ARCTIC Final Report
David P. Hoult, Stephen Wolfe, Stephen ODea, and Jean P. Patureau Mar. 1975 219 p refs
(Contract DOT-CG-12438-A; CG Proj. 4108.2.3)
(AD-A010269; USCG-D-96-75) Avail: NTIS CSCL 13/2

The report describes the results of several researches on the behavior of oil spilled in the arctic. Included are studies on evaporation, spreading and maximum extent of oil spilled on ice, and the behavior of oil spilled under ice. Physically sound theories are developed which correlate well with laboratory and field data. GRA

N75-32577# Battelle Columbus Labs., Ohio.
ENVIRONMENTAL CONSIDERATIONS FOR OIL SHALE DEVELOPMENT Final Report, Jan. - May 1974
Nick Conkle, Vernon Ellzey, and Keshava Murthy Oct. 1974 133 p refs
(Contract EPA-68-02-1323)
(PB-241942/2; EPA-650/2-74-099) Avail: NTIS HC $5.75 CSCL 08I

The report provides an overview of the anticipated oil shale industry, including the magnitude of the resources available and the likely technical environmental problems to be encountered. Specific technologies likely to be employed in the mining, oil extraction, and onsite upgrading processes are also identified. The status of development of these technologies and their potential economic, resource, and environmental impacts upon the oil shale resource regions and the nation as a whole are also described. GRA

N75-32578# Coast and Geodetic Survey, Washington, D.C.
PLANE COORDINATE INTERSECTION TABLES (2 1/2-MINUTE)-CALIFORNIA Special Publication
1975 287 p
(COM-75-10736/7; SP-327; NOAA-75050804) Avail: NTIS HC $8.75; also available from SOD CSCL 08E

The tables in this publication contain the plane coordinates for 2 1/2-minute intersections of meridians and parallels within the limits of the state of California. These plane coordinates, based on the state plane-coordinate system established by the U.S. Coast and Geodetic Survey, are arranged by 12 1/2-minute bands of latitude with the full range of longitude of the zone, followed by the coordinates for the next higher band of latitude. They are also arranged by zone. The purpose of these tables is for use in making maps. Meridians and parallels may be placed on maps constructed on a rectangular grid of the state system, or the grid lines of the system may be placed on maps constructed on a projection of meridians and parallels. Also, approximate values of plane coordinates of geographic positions may be obtained by interpolation within the tables. GRA

N75-32579# Hazen Research, Inc., Golden, Colo.
PROCESS TECHNOLOGY FOR RECOVERING GEOTHERMAL BRINE MINERALS
C. E. Berthold, Pablo Hadzeriga, David H. Christopher, Thomas A. Applegate, and Daniel M. Gillespie 4 Feb. 1974 255 p refs
(Contract DI-BM-SO-133084)
(PB-241867/1; BM-OFR-35-75) Avail: NTIS HC $8.50 CSCL 08I

Geothermal fluids and hot springs waters from California and Nevada were sampled and analyzed to provide a basis for process development and economic studies on the potential for recovering valuable minerals from these fluids. In general, bulk precipitation methods were used to remove the valuable constituents from the geothermal fluids, followed by separation of the constituents from this bulk precipitate. Concentration of geothermal fluids to recover soluble saline constituents such as sodium chloride and calcium chloride does not appear practical, owing primarily to the probable need for reinjecting such fluids back into the production zone. GRA

N75-32580# Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM Ph.D. Thesis. Technical Report, Nov. 1957 - Jul. 1958
Alfred R. Grzenda, Robert C. Ball, and Niles R. Kevern Oct. 1968 83 p refs Sponsored in part by NIH
(PB-242111/3; MSU-IWR-TR-68-0002; TR-2) Avail: NTIS HC $4.75 CSCL 06C

Primary production, energetics, and nutrient fixation were investigated in the Red Cedar River, a warm-water stream located in the south central portion of the Lower Peninsula of Michigan. Periphyton harvested from plexiglass substrata were utilized to determine gravimetric net production estimates, and colorimetric productivity measurements were made by relating the absorbency of phytopigments extracted from the periphyton colony to the ash-free dry weight of the colony. The effect of floods on the seasonal distribution of phosphorus and nitrogen indicates that sanitary drains are the major source of phosphorus and surface runoff the chief source of inorganic nitrogen. GRA

N75-32518 Joint Publications Research Service, Arlington, Va.
RESULTS OF THE INTERNATIONAL HYDROLOGIC DECADE
A. A. Sokolov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 1-10 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 3-10 (For availability see N75-32517 23-42)

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N75-32581* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR ENERGY POWER SYSTEM Patent
Billy K. Davis, inventor (to NASA) Issued 9 Sep. 1975 18 p Filed 4 Dec. 1973 Supersedes N74-14496 (12 - 05, p 0586)
(NASA-Case-MFS-21628-1; US-Patent-3,903,699;
US-Patent-Appl-SN-421702; US-Patent-Class-60-641;
US-Patent-Class-165-105; US-Patent-Class-126-271;
US-Patent-Class-244-173; US-Patent-Class-60-659) Avail: US Patent Office CSCL 10A

A solar energy vapor (Freon) powered system for generating electrical energy is described in which a portion of the heat absorbed from the sun in daylight is stored for use during darkness by a thermal capacitor. A mass of Pyrone, having a high thermal capacity, liquifies when heat is applied to it and goes through a solidification process to provide a heat output. A highly efficient solar boiler is constructed utilizing an anodized titanium surface and a particular combination of shaped boiler tubes and complementary reflectors. The overall efficiency of the system is further improved by a unique arrangement of heat recovery devices. Official Gazette of the U.S. Patent Office

N75-32582 Temple Univ., Philadelphia, Pa.
AN ECONOMETRIC STUDY OF THE UNITED STATES PETROLEUM INDUSTRY Ph.D. Thesis
Jack Windell Wilkinson 1974 282 p
Avail: Univ. Microfilms Order No. 75-28380

A theoretical approach to the determination of demand, supply, and price for crude petreoleum and petroleum products was developed and an econometric model consisting of 23 behavioral and 56 identify equations was constructed. The model is an annual one covering the period 1947-1970. The parameters of the behavioral relations are estimated by the two-stage least squares technique. The model is dynamic and structured with a recursive and a simultaneous block. A set of assumptions pertaining to the exogenous variables for the period 1965-1970 was selected for response calculations. A forecast is prepared for the period 1971-1976. Beyond 1972 demand is expected to increase rapidly, while moderate price increases are forecast. Domestic supply, however, is projected to be quite inadequate. If the forecasts are directionally correct, it is concluded that the domestic petroleum industry will become increasingly dependent upon crude oil and product imports. Dissert. Abstr.

N75-32583*# National Aeronautics and Space Administration, Washington, D.C.
RECHARGEABLE BATTERY WHICH COMBATS SHAPE CHANGE OF THE ZINC ANODE Patent Application
Ernst M. Cohn, inventor (to NASA) Filed 13 Aug. 1975 15 p
(NASA-Case-HQN-10862-1; US-Patent-Appl-SN-604374) Avail: NTIS HC $3.25 CSCL 10A

A rechargeable cell or battery is described which minimizes the shape change of the zinc anode. The ionic conductivity of the paths between the electrodes is controlled so that ion flow is greatest at the edges of the electrodes and least at the centers reducing migration of the zinc ions from the edges to the center of the anode. Several embodiments of the invention are presented and discussed. NASA

N75-32584*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELECTED TECHNOLOGY FOR THE GAS INDUSTRY
Washington 1975 87 p refs Conf. held at Cleveland, Mar. 19-20 1975
(NASA-SP-5103) Avail: NTIS HC $10.50 CSCL 10B

A number of papers were presented at a conference concerned with the application of technical topics from aerospace activities for the gas industry. The following subjects were covered: general future of fossil fuels in America, exploration for fossil and nuclear fuels from orbital altitudes, technology for liquefied gas, safety considerations relative to fires, explosions, and detonations, gas turbomachinery technology, fluid properties, fluid flow, and heat transfer, NASA information and documentation systems, instrumentation and measuremment, materials and life prediction, reliability and quality assurance, and advanced energy systems (including synthetic fuels, energy storage, solar energy, and wind energy). Y.J.A.

N75-32585*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INTERIM PERFORMANCE CRITERIA FOR COMMERCIAL SOLAR HEATING AND COMBINED HEATING/COOLING SYSTEMS AND FACILITIES
28 Feb. 1975 120 p refs
(NASA-TM-X-64958; Doc-98M10001) Avail: NTIS HC $5.25 CSCL 10B

Interim performance criteria are presented for designing and evaluating solar heating and cooling systems for commercial applications. Systems and subsystems discussed include: heating, combined heating and cooling, hot water, energy transport, control, auxiliary energy, collectors, and storage. F.O.S.

N75-32586*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRICALLY RECHARGEABLE REDOX FLOW CELL Patent Application
L. H. Thaller, inventor (to NASA) Filed 22 Aug. 1975 18 p
(NASA-Case-LEW-12220-1; US-Patent-Appl-SN-606891) Avail: NTIS HC $3.25 CSCL 10A

A bulk energy storage system is described. The system includes an electrically rechargeable reduction-oxidation cell divided by a membrane into two compartments, each containing an electrode. An anode fluid is directed through the first compartment at the same time a cathode fluid is directed through the second, thereby causing the electrode in the first to have a negative potential while the electrode in the second has a positive potential. The electrodes are inert with respect to the anode and cathode fluids and the dividing membrane is substantially impermeable to all except select ions of both fluids. The electrodes are connected to an intermittent electrical source which supplies current to a load as well as to the cell to recharge it. Ancillary circuitry is provided for disconnecting the intermittent source from the cell at prescribed times and for circulating the anode and cathode fluids according to desired parameters and conditions. NASA

N75-32587# Joint Economic Committee (U. S. Congress).
ENERGY STATISTICS
Washington GPO 1974 452 p refs Hearings before Subcomm. on Priorities and Economy in Govt. of Joint Economic Comm., 93d Congr., 1st and 2d Sess., 14 and 21 Jan. 1974 2d Sess., 14 and 21 Jan. 1974
(GPO-37-143) Avail: SOD HC $3.85

The hearings to determine the facts on oil production, reserves, inventories, and consumption are reported. Topics discussed include: mandatory oil import control program; oil import question; reserves of crude oil, natural gas liquids, and natural gas. F.O.S.

N75-32588*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ELECTRICAL PERFORMANCE OF Ag Zn BATTERIES FOR THE VENUS MULTI-PROBE MISSION
Charles Palandati Jun. 1975 45 p refs
(NASA-TM-X-72876; X-711-75-197) Avail: NTIS HC $3.75 CSCL 10C

An evaluation of 5 Ah and 21 Ah Silver-Zinc batteries was made to determine their suitability to meet the energy storage requirements of the bus vehicle, 3 small probes and large probe for the Venus multi-probe mission. The evaluation included a 4 Ah battery for the small probe, a 21 Ah battery for the large probe, one battery of each size for the bus vehicle power, a periodic cycling test on each size battery and a wet stand test of charged and discharged cells of both cell designs. The study on the probe batteries and bus vehicle batteries included both electrical and thermal simulation for the entire mission. The effects on silver migration and zinc penetration of the cellophane separators caused by the various test parameters were determined by visual and X-ray fluorescence analysis. The 5 Ah batteries supported the power requirements for the bus vehicle and small probe. The 21 Ah large probe battery supplied the required mission power. Both probe batteries delivered in excess of 132 percent of rated capacity at the completion of the mission simulation. Author

N75-32589*# Pittsburgh Univ., Pa. Dept. of Chemical and Petroleum Engineering.
THE RESEARCH AND DEVELOPMENT OF A SOLUBLE REACTANTS AND PRODUCTS SECONDARY BATTERY SYSTEM Annual Report, 1 May 1974 - 31 Jul. 1975
Chung-Chiun Liu 31 Jul. 1975 59 p refs
(Grant NsG-3010)
(NASA-CR-143510) Avail: NTIS HC $4.25 CSCL 10A

A redox battery system which employs an aqueous dectrolyte is developed. Results are presented of the following experimental studies (1) measurement of the essential physical and chemical

properties of the reactants and products; (2) evaluation of commerically available anion membranes as the cell separator, (3) determination of the composition and degradation mechanism of the anion membrane, and/or developing an anion membrane separator; and (4) evaluation of the performance of prototype secondary battery systems. J.M.S.

N75-32590# Lockheed Missiles and Space Co., Palo Alto, Calif.
FULL-SCALE TESTING OF HIGH-VOLTAGE PHOTOCELLS OF FOTOVOLT TYPE AT ELEVATED LIGHT FLUX LEVELS
U. A. Arifov, M. Gaibnazarov, B. N. Dzhalilov, A. I. Kulagin, A. P. Landsman, and D. S. Strebkoi 1974 7 p refs Transl. into ENGLISH from Geliotekhnika, Akad. Nauk Uz. SSR (Tashkent), no. 6, 1974 p 3-9
Avail: NTIS HC $3.25; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Photoelectric batteries were investigated for use in solar power plants operating under high radient flux density at high temperatures. The energy distribution in the focal and out-of-focus planes of a paraboloidal concentrator are presented along with the results of measuring the volt-ampere characteristics at diverse solar ray concentrations. It is shown that a diminution of the spreading and contact resistances of photocells will permit taking off hundreds of times more power in useful load than that for the customary frontal photocells. F.O.S.

N75-32591*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLAT-PLATE SOLAR-COLLECTOR PERFORMANCE EVALUATION WITH A SOLAR SIMULATOR AS A BASIS FOR COLLECTOR SELECTION AND PERFORMANCE PREDICTION
Frederick F. Simon 1975 52 p refs Presented at 1975 Intern. Solar Energy Soc. Meeting, Los Angeles, 28 Jul. - 8 Aug. 1975
(NASA-TM-X-71793; E-8470) Avail: NTIS HC $4.25 CSCL 10B

The use of a solar simulator for performance determination permits collector testing under standard conditions of wind, ambient temperature, flow rate and sun. The performance results determined with the simulator have been found to be in good agreement with outdoor performance results. The measured thermal efficiency and evaluation of 23 collectors are reported which differ according to absorber material (copper, aluminum, steel), absorber coating (nonselective black paint, selective copper oxide, selective black nickel, selective black chrome), type of glazing material (glass, Tedlar, Lexan, antireflection glass), the use of honeycomb material and the use of vacuum to pervent thermal convection losses. The collectors were given performance rankings based on noon-hour solar conditions and all-day solar conditions. The determination with the simulator of an all-day collector performance was made possible by tests at different incident angles. The solar performance rankings were made based on whether the collector is to be used for pool heating, hot water, absorption air conditioning, heating, or for a solar Rankine machine. Author

N75-32592*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA-LEWIS/ERDA SOLAR HEATING AND COOLING TECHNOLOGY PROGRAM
James P. Couch and Harvey S. Bloomfield 1975 15 p refs Presented at Workshop on the use of Solar Energy for the Cooling of Buildings, Los Angeles, 4-6 Aug. 1975; Cosponsored by Intern. Solar Energy Soc. and the Am. Soc. of Heating, Refrig., and Air-Conditioning Engineers
(NASA-TM-X-71800; E-8478) Avail: NTIS HC $3.25 CSCL 10A

Plans by NASA to carry out a major role in a solar heating and cooling program are presented. This role would be to create and test the enabling technology for future solar heating, cooling, and combined heating/cooling systems. The major objectives of the project are to achieve reduction in solar energy system costs, while maintaining adequate performance, reliability, life, and maintenance characteristics. The project approach is discussed, and will be accomplished principally by contract with industry to develop advanced components and subsystems. Advanced hardware will be tested to establish 'technology readiness' both under controlled laboratory conditions and under real sun conditions. Author

N75-32593*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COST AND SIZE ESTIMATES FOR AN ELECTROCHEMICAL BULK ENERGY STORAGE CONCEPT
Marvin Warshay and Lyle O. Wright 1975 12 p refs Presented at Energy Storage Session of the 148th Meeting of the Electrochemical Soc., Dallas, 5-9 Oct. 1975
(NASA-TM-X-71805; E-8138) Avail: NTIS HC $3.25 CSCL 10C

Preliminary capital cost and size estimates were made for an electrochemical bulk energy storage concept. The electrochemical system considered was an electrically rechargeable flow cell with a redox couple. On the basis of preliminary capital cost estimates, size estimates, and several other important considerations, the redox-flow-cell system emerges as having great promise as a bulk energy storage system for power load leveling. The size of this system would be less than 2 percent of that of a comparable pumped hydroelectric plant. The capital cost of a 10-megawatt, 60- and 85-megawatt-hour redox system is estimated to be $190 to $330 per kilowatt. The other important features of the redox system contributing to its load leveling application are its low adverse environmental impact, its high efficiency, its apparent absence of electrochemically-related cycle life limitations, and its fast response. Author

N75-32594*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY RESULTS OF THE LARGE EXPERIMENTAL WIND TURBINE PHASE OF THE NATIONAL WIND ENERGY PROGRAM
Ronald L. Thomas, Thomas Sholes, and John E. Sholes 1975 25 p refs Presented at Frontiers of Technol. Conf., Stillwater, Oklahoma, 1-2 Oct. 1975; Sponsored by Oklahoma State Univ.
(NASA-TM-X-71796; E-8475) Avail: NTIS HC $3.25 CSCL 10B

The preliminary results of two projects in the development phase of reliable wind turbines designed to supply cost-competitive electrical energy were discussed. An experimental 100 kW wind turbine design and its status are first reviewed. The results of two parallel design studies for determining the configurations and power levels for wind turbines with minimum energy costs are also discussed. These studies predict wind energy costs of 1.5 to 7 cents per kW-h for wind turbines produced in quantities of 100 to 1000 per year and located at sites having average winds of 12 to 18 mph. Author

N75-32595*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INITIAL COMPARISONS OF SOLAR COLLECTOR PERFORMANCE DATA OBTAINED OUT-OF DOORS AND WITH A SOLAR SIMULATOR
Richard W. Vernon 1975 14 p refs Presented at 1975 Intern. Solar Energy Soc. Meeting, Los Angeles, 28 Jul. - 1 Aug. 1975
(NASA-TM-X-71626; E-8472) Avail: NTIS HC $3.25 CSCL 10B

A facility was constructed to evaluate solar collector performance outdoors for conditions that would be encountered by collectors if they were incorporated in a solar heating/cooling system. In addition to obtaining initial collector performance data, the outdoor facility will enable collector durability and degradation rates to be evaluated for operating periods of several months. The data obtained from the outdoor tests were compared to collector performance predicted on the basis of results obtained with a solar simulator. The performance measured outdoors was less than the predicted performance. Author

N75-32596# Naval Academy, Annapolis, Md. Environmental Protection Research and Development Team.
CONVERTING CELLULOSIC WASTE TO FUEL: A LITERATURE REVIEW Interim Report, 1 Jul. 1974 - 1 Feb. 1975
Mark M. Bundy Feb. 1975 23 p refs
(AD-A009400; USNA-EPRD-9) Avail: NTIS CSCL 07/1

Preliminary findings show five processes that will convert discarded cellulosic material into a useable fuel. These processes,

hydrogenation, hydrogasification, pyrolysis, bioconversion and catalytic conversion of synthesis gas produce a pipeline quality gas, a fuel oil comparable to No. 6, or methyl fuel, all with heating values great enough to meet Naval operational needs. The report is a summary of these processes and their products. GRA

N75-32597*# National Bureau of Standards, Washington, D.C. Comsumer Product Systems Section.
AN EVALUATION OF POTENTIALLY USEFUL SEPARATOR MATERIALS FOR NICKEL-CADMIUM (Ni-Cd) SATELLITE BATTERIES Final Report
H. A. Baker, S. D. Toner, and W. F. Cuthrell Oct. 1974 38 p refs Sponsored in part by NASA
(NASA-CR-143504; COM-75-10618/7; NBSIR-74-541) Avail: NTIS HC $3.75 CSCL 10C

An evaluation intended to determine the potential suitability and probable efficacy of a group of separator materials for use in nickel-cadmium (Ni-Cd) satellite batteries was carried out. These results were obtained using test procedures established in an earlier evaluation of other separator materials, some of which were used in experimental battery cells subjected to simulated use conditions. The properties that appear to be most important are: high electrolyte absorptivity, good electrolyte retention, low specific resistivity, rapid wettability and low resistance to air permeation. Wicking characteristics and wet-out time seem to be more important with respect to the initial filling of the battery with the electrolyte. GRA

N75-32598# Naval Postgraduate School, Monterey, Calif.
ELECTRICAL ENERGY ALLOCATIONS AT NAVY AND MARINE CORPS BASES M.S. Thesis
Alexander Shalar Mar. 1975 123 p refs
(AD-A009821) Avail: NTIS CSCL 10/1

Navy and Marine Corps bases in the continental United States derive almost all of their electricity from public utility companies. For this thesis, the conditions of service of select public utility companies in one part of the United States, the West Coast, were investigated. Particular attention was devoted to the utility companies: plans to allocate electricity to their customers if an emergency or a fuel shortage should occur. The second major area investigated was the internal management of electricity within Navy and Marine Corps bases. The load shedding plans of about 80 bases were reviewed, and from these, guidelines were developed for the preparation of an optimal load shedding plan. Also, a unique approach to electrical allocation was developed. The approach is based on the utility theory of economics. GRA

N75-32599# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab for Physical Science.
SEALED PRIMARY LITHIUM-INORGANIC ELECTROLYTE CELL Quarterly Report, 1 Dec. 1974 - 28 Feb. 1975
A. N. Dey May 1975 43 p refs
(Contract DAAB07-74-C-0109; DA Proj. 1S7-62705-AH-94) (AD-A010398; ECOM-74-0109-4; QR-4) Avail: NTIS CSCL 10/3

Research continued on the shelf life evaluation of the hermetic Li/SOCl2-1(M)LiAlCl4 - D cell that the authors developed during the first three quarters. Explosion hazard studies have been carried out in an effort to find ways and means of alleviating the problem. The explosion hazards of the cells can be reduced by decreasing the effective electrode areas with a corresponding loss in the rate capability of the cell. Whether or not this will prevent the fire hazards on forced discharge is still unknown. The program has been extended for six months to permit a more detailed study of the explosion hazards. GRA

N75-32600# Environmental Protection Agency, Philadelphia, Pa.
IMPLEMENTATION PLAN REVIEW FOR DISTRICT OF COLUMBIA AS REQUIRED BY THE ENERGY SUPPLY AND ENVIRONMENTAL COORDINATION ACT Final Report
Mar. 1975 32 p Prepared in cooperation with TRW, Inc., Vienna, Va.
(Contract EPA-68-02-1385)
(PB-241626/1; EPA-450/3-75-039) Avail: NTIS HC $3.75 CSCL 13B

Section 4 of the Energy Supply and Environmental Coordination Act of 1974, (ESECA) requires EPA to review each State Implementation Plan (SIP) to determine if revisions can be made to control regulations for stationary fuel combustion sources without interfering with the attainment and maintenance of the national ambient air quality standards. This document, which is also required by Section 4 ESECA, is EPA's report to the State indicating where regulations might be revised. GRA

N75-32601# Kell, Alterman, Runstein, and Thomas, Portland, Oreg.
POWER SHORTAGE CONTINGENCY PROGRAM FOR THE PACIFIC NORTHWEST. LEGISLATIVE, REGULATORY AND INSTITUTIONAL ASPECTS
Leon Jourolmon 1975 402 p refs
(PB-241323/5; W75-06977) Avail: NTIS HC $10.50 CSCL 10A

Principles are evaluated which are applied when use of electricity must be rationed either because of critical levels of streamflow or because of slippage of generator schedules, or both. The legal structure controlling the marketing of power throughout the Columbia Basin is examined. GRA

N75-32602# Electric Power Research Inst., Palo Alto, Calif.
EVALUATION OF FIXED BED, LOW BTU COAL GASIFICATION SYSTEMS FOR RETROFITTING POWER PLANTS Interim Report
D. A. Waitzman, H. L. Faucett, E. E. Kindahl, S. V. Tomlinson, and D. E. Nichols Feb. 1975 281 p refs Sponsored by Electric Power Res. Inst., Palo Alto, Calif.
(PB-241672/5; TVA-Bull-Y-91; EPRI-203-1) Avail: NTIS HC $8.75 CSCL 10B

Seven alternative systems are considered: (1) Wellman-Galusha/Benfield System, (2) Wellman-Galusha/Stretford System, (3) Wellman-Galusha/Iron Oxide System, (4) Wellman-Galusha/Iron Oxide/Fines Gasification System, (5) Lurgi/Benfield System, (6) Lurgi/Stretford System, and (7) Lurgi/Iron Oxide System. Conceptual designs and capital and operational cost estimates are provided for six of the systems including associated coal handling, fines removal and sales (or gasification in the Wellman-Galusha/iron oxide/fines gasification system), air compression and boiler modifications. The report estimates the cost of and describes low-Btu, fixed-bed gasification plants that might be operated in the near future on retrofitted power plants, and compares fixed-bed gasification with stack gas cleaning processes. GRA

N75-32603# Bureau of Mines, Pittsburgh, Pa. Pittsburg Mining and Safety Research Center.
IN SITU COMBUSTION OF COAL FOR ENERGY Technical Progress Report
Robert F. Chaiken Nov. 1974 16 p refs Previously announced as N75-11464
(PB-241892/9; BM-TPR-84; N75-11464) Avail: NTIS HC $3.25 CSCL 08I

A concept of efficient thermal energy generation through the in situ combustion of coal, and the on-site conversion of that energy to electricity is discussed and shown to offer distinct advantages in the utilization of our coal reserves. Analysis of data from previous underground coal gasification projects suggest that coal can be efficiently burned underground and that the burning process should be maintainable for time periods sufficient to power a commerical electricity generation plant. A discussion is presented related to the requirements of a 100 megawatt (thermal) demonstration in-situ combustor, and some of the important problem areas that have to be resolved prior to implementation of the concept. GRA

N75-32604# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENERGETICS FORECASTS ON THE BASIS OF TIME SERIES ANALYSIS
R. Redulets and C. Nog 25 Oct. 1974 10 p Transl. into ENGLISH from the mono "Teoriya i Praktika Prognozirovaniya Rezvitiya Nauki i Tekhniki v Stranakh-Chlenakh Sev" Moscow, 1971 p 305-309
(AD-A001148; FTD-HC-23-2367-74) Avail: NTIS CSCL 10/2

The report discusses the use of time series analysis to predict electric power consumption. GRA

N75-32605# Army War Coll., Carlisle Barracks, Pa.
UNIQUE ELECTRIC POWER AND WATER DESALINATION SCHEME UNDERWAY IN LIBYA
Charles N. Eason 21 Feb. 1975 30 p refs
(AD-A009950) Avail: NTIS CSCL 10/2

With continuing interest in the Mediterranean and the Middle East as a backdrop, focus is put on the basic necessities of water and power in Libya. An analysis is made, on a national basis, of the choice of means for meeting an urgent need for both power and potable water in an economy, exploding in development with limited skills, but with unlimited funds. This could be typical of situations in several Mid-East nations. A discussion includes factors of fuels, fuel costs, capital costs, efficiency, reliability, potential for local operation and timing. These several elements are weighed by the Libyans. The resulting decisions are sound, however, they have adopted a highly sophisticated combination of gas turbine-generators (GT), and heat recovery steam generators (HRSG) to produce steam for water desalination plants at several locations. GRA

N75-32606# Kellogg (M. W.) Co., Houston, Tex. Research and Engineering Development.
IDENTIFICATION AND CHARACTERIZATION OF THE USE OF MIXED CONVENTIONAL AND WASTE FUELS Final Report
Gopal K. Mathur Feb. 1975 65 p
(Contract EPA-68-02-1308)
(PB-241821/8; EPA-650/2-75-017) Avail: NTIS HC $4.25 CSCL 10A

The major objective of this study was to identify and classify types and properties of mixed fuels presently in use, and types of stationary processes using mixed fuels. Types of fuels presently in use, and types of stationary processes using mixed fuels. Types of mixed fuels include mixed oils; oil and gas; coal and oil; coal and gas; by-product gases and fuels; by-product chemical waste; and mixtures of chemical wastes and conventional fossil fuels. The scope of the task covered industries in the category of utilities, petroleum refineries, petrochemical, chemical processing (excluding fertilizer), glass, cement and textile. A list of manufacturers of mixed fuel burners was developed. GRA

N75-32607# Dow Chemical Co., Freeport, Tex.
ENERGY CONSUMPTION: PAPER, STONE/CLAY/GLASS/CONCRETE, AND FOOD INDUSTRIES Final Report, Aug. 1974 - Mar. 1975
John T. Reding and Burchard P. Shepherd Apr. 1975 60 p refs
(Contract EPA-68-02-1329)
(PB-241926/5; EPA-650/2-75-032-c) Avail: NTIS HC $4.25 CSCL 10A

Energy-intensive steps or operations for commonly used manufacturing processes are examined. Results of the analyses are in the form of energy consumption block diagrams, energy-intensive equipment schematic diagrams, and tables that indicate the causes of energy losses, as well as possible conservation approaches. GRA

N75-32608# Dow Chemical Co., Freeport, Tex.
ENERGY CONSUMPTION: THE CHEMICAL INDUSTRY Final Report, Aug. 1974 - Mar. 1975
John T. Reding and Burchard P. Shepherd Apr. 1975 71 p refs
(Contract EPA-68-02-1329)
(PB-241927/3; EPA-650/2-75-032-a) Avail: NTIS HC $4.25 CSCL 10A

The report gives results of a study of energy consumption in the chemical industry. It analyzes energy-intensive steps or operations for manufacturing processes which produce 12 of the top 50 volume chemicals in the U.S. Results of the analyses are in the form of energy consumption block diagrams, energy-intensive equipment schematic diagrams, and tables that indicate the causes of energy losses, as well as possible conservation approaches. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N75-32609 Southern Methodist Univ., Dallas, Tex.
ENGINEERING HYDRAULIC: AN INVESTIGATION OF THE EFFECT OF DISCHARGE GEOMETRY ON THERMAL DISCHARGE PHENOMENA Ph.D. Thesis
Leon Wayne Sanders 1975 377 p
Avail: Univ. Microfilms Order No. 75-18935

An experimental laboratory lake was designed and constructed complete with a hot water discharge system, temperature measurement system and velocity measurement system. A total of 134 experimental runs were made and original data obtained. Four types of entrance conditions were studied, including two which had not been previously studied. One of these included a study of the free overfall type of entrance. The experiments with the hot water discharges conclusively showed that inlet geometry and flow velocities strongly influence mixing phenomena. Seven runs were made to determine velocity profiles in the test basin for the different inlet types. Mean velocity and turbulent intensity profiles were obtained. These profiles were used to determine entrainment coefficients for each one of the four entrance types. Dissert. Abstr.

N75-32610 Michigan Univ., Ann Arbor.
AZONE AND PARTICULATE FORMATION IN PHOTOCHEMICAL REACTIONS Ph.D. Thesis
Chi-Hung Shen 1975 135 p
Avail: Univ. Microfilms Order No. 75-20446

Experiments were performed to investigate the photochemical formation of nuclei and aerosols in sulfur dioxide-air mixtures and the photochemical formation of ozone, nuclei, and aerosols in cyclohexene-nitrogen dioxide-air mixtures, using irradiation by ultraviolet fluorescent lamps. The amounts of ozone, nuclei, and aerosols generated in the mixtures were measured at various points. The results showed that the maximum number of nuclei produced is directly proportional to the initial sulfur dioxide concentration and to the square of the relative humidity. The amount of ozone produced depends on the initial concentration of cyclohexene and nitrogen dioxide as well as on the light intensity. The maximum number of nuclei produced varies directly with the square root of both the cyclohexene concentration and the nitrogen dioxide concentration. The aerosol size distributions were also measured and followed closely Friedlander's universal self-preserving curve. Dissert. Abstr.

N75-32611 Florida Univ., Gainesville.
PARTICLE SIZE SPECTRUM AND COMPRESSIBILITY OF RAW AND SHREDDED MUNICIPAL SOLID WASTE Ph.D. Thesis
John Adam Ruf 1974 374 p
Avail: Univ. Microfilms Order No. 75-19387

The particle size spectra and density-compressibility of raw and shredded municipal solid waste were investigated. The particle size spectra for the composite wastes and their constituents were determined using large soil-aggregate sieves. Mathematical functions were fitted to the particle distributions for the separate components, and methodologies were developed for predicting the size distributions of different raw and processed composite wastes. To determine density-compressibility, samples were placed into a cylinder and loose bulk density was measured. The samples were then statically loaded using a hand-pumped hydraulic cylinder with a large steel piston. Increased pressures were incrementally applied and corresponding densities were measured. The dry bulk density varied with the logarithm of applied pressure. Particle size distribution and sample composition were also important factors. Mathematical functions were fitted to the data. The described analytical techniques were found to be dependable and reproducible, and the models were accurate in predicting the data obtained. Dissert. Abstr.

N75-32612 Michigan Univ., Ann Arbor.
INTERDEPENDENCE AND COORDINATION WITHIN STATE ENVIRONMENTAL PROTECTION AGENCIES Ph.D. Thesis
Carl Ralph Stapleton 1975 240 p

Avail: Univ. Microfilms Order No. 75-20455

The relationships between coordinative mechanisms and interdependency types in state environmental protection agencies (EPAS) were expressed in three hypotheses. Hypothesis 1 states that a statistically significant positive relationship exists between pooled interdependent units of the agencies. Hypothesis 2 states that such a relationship exists between planning and coordination between sequentially interdependent units. Hypothesis 3 states that such a relationship exists between mutual adjustment and coordination between reciprocally interdependent units. To test these hypotheses, data were collected from the Ohio and Illinois EPAs. Hypotheses 1 and 2 were fully supported by the data. Hypothesis 3 was only partially supported by the results. However, further analysis revealed inter-unit tension which may have lowered the correlations between mutual adjustment and coordination between the units. The reverse could also be true; i.e. poor coordination could be responsible for increased tension.

Dissert. Abstr.

N75-32613 Michigan Univ., Ann Arbor.

A SYSTEMATIC APPROACH FOR MINIMIZING THE COSTS OF AIR POLLUTION CONTROL Ph.D. Thesis

James Bert Lancour 1975 111 p

Avail: Univ. Microfilms Order No. 75-20385

A systematic approach for minimizing the costs of air pollution control for an industrial facility is described. The approach was applied to the evaluation and control of particulate emissions from the manufacture of glass fiber insulation products. The emissions from each phase of the operation were characterized and compared with emission standards. For each source where emission standards were exceeded, the costs associated with owning, operating and maintaining several levels of control for various control alternatives were projected over a ten year period. Cash flow was adjusted to account for taxes, depreciation, interest and timing. From these data the combination of controls which minimized the cost of complying with emission standard was determined. The effect of these controlled emissions on ambient air quality was then calculated to determine if standards had been met. Where they had not, the cost of installing the additional controls was also minimized. Dissert. Abstr.

N75-32614*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE RELOCATION OF PARTICLE CONTAMINATION DURING SPACE FLIGHT

Jack Barengoltz and Darryl Edgars (Bionetics Corp.) 1 Sep. 1975 140 p refs

(Contract NAS7-100)

(NASA-CR-143503; JPL-TM-33-737) Avail: NTIS HC $5.75 CSCL 13B

A computer simulation program to model the redistribution of particulate contaminants on a spacecraft after launch is developed. The component models for particulate adhesion, meteoroid impact, and electrostatic forces are described and intermediate results are presented. The results of a sample calculation show that the recontamination process is important.

Author

N75-32615*# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.

AN ASSESSMENT OF THE IMPACT OF THE SPACE SHUTTLE ON STRATOSPHERIC OZONE USING A 3-D PHOTOCHEMICAL DYNAMICAL STRATOSPHERIC MODEL Semiannual Status Report, 28 Feb. 1975 - 31 Aug. 1975

Ronald G. Prinn 31 Aug. 1975 28 p refs

(Grant NsG-2010)

(NASA-CR-119140) Avail: NTIS HC $3.75 CSCL 04A

Preliminary tests of 2-D and 3-D models for the evaluation of space shuttle impact on stratospheric ozone are described. The first runs were designed to simulate the present stratosphere; the second runs were intended to simulate the stratosphere perturbed by a constant upward flux of chlorofluorocarbons under quasi-steady state conditions. Improvements to the 3-D model include elimination of the need for significant sub-grid-scale diffusion coefficients above the tropopause, and the inclusion of Southern hemisphere orography and heating. Progress toward utilization of the ILLIAC IV computer is reviewed. Author

N75-32616*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GASEOUS EXHAUST EMISSIONS FROM A JT8D-109 TURBOFAN ENGINE AT SIMULATED CRUISE FLIGHT CONDITIONS

Larry A. Diehl and James D. Holdeman Washington Oct. 1975 19 p refs

(NASA-TM-X-3290; E-8367) Avail: NTIS HC $3.25 CSCL 13B

Gaseous emissions from a JT8D-109 turbofan engine were measured in an altitude facility at four simulated cruise flight conditions: Mach 0.8 at altitudes of 9.1, 10, 7, and 12.2 km and Mach 0.9 at 10.7 km. Engine inlet air temperature was held constant at 283 K for all tests. Emissions measurements were made at nominally 6 cm intervals across the horizontal diameter of the engine exhaust nozzle with a single-point traversing gas sample probe. Measured emissions of decreased with increasing altitude from an emission index of 10.4 to one of 8.3, while carbon monoxide increased with increasing altitude from an emission index of 1.6 to one of 4.4. Unburned hydrocarbon emissions were essentially negligible for all flight conditions. Since the engine inlet air temperatures were not correctly simulated, the NOx emission indices were corrected to true altitude conditions by using correlating parameters for changes in combustor inlet temperature, pressure, and temperature rise. The correction was small at the lowest altitude. At the 10.7 and 12.2 km, Mach 0.8 test conditions the correction decreased the measured values by 1 emission index. Author

N75-32617# Illinois Inst. for Environmental Quality, Chicago.

OXIDANTS IN THE URBAN ATMOSPHERE Final Report

J. E. Quon (Northwestern Univ.) and R. A. Wadden (Illinois Univ., Chicago) Jan. 1975 87 p refs

(IIEQ Proj. 10.034)

(PB-241355/7; IIEQ-75-04) Avail: NTIS HC $4.75 CSCL 13B

The major objectives of this study were to identify the main features of the photochemical formation of oxidants, to develop an understanding of the transport and dispersion of photochemical reactants and reaction products, and to elucidate the relationships between the different types of emission sources and the formation of oxidants in the air. Measurements of ozone in Illinois at a number of monitoring stations during the summer of 1974 show that the concentrations exceeded the ambient air quality standard for oxidants on a number of occasions. The daily peak hour is in general high for high air temperatures and low wind speeds, although the relationship is not well defined. GRA

N75-32618# Environmental Protection Agency, Washington, D.C. Office of Research and Development.

FEDERAL NOISE EFFECTS RESEARCH FISCAL YEAR 1973 - FISCAL YEAR 1975 Final Report

Mar. 1975 153 p

(PB-241751/7; EPA-600/1-75-001) Avail: NTIS HC $6.25 CSCL 13B

Potential effects of noise on the public health and welfare are described, limitations and gaps in necessary knowledge of those effects are identified as research needs, and eight categories for analyzing noise effects research are presented. The current Federal research programs are summarized for each of the eight categories. The Noise Effects Research Panel through its collective knowledge of the needs and the current research has identified specific research areas need additional emphasis in order to provide accurate and thorough information on effects of noise. GRA

N75-32619# Pennsylvania State Univ., University Park.

SELECT RESEARCH GROUP IN AIR POLLUTION METEOROLOGY, VOLUME 1 Annual Progress Report, 1 Jun. 1973 - 30 Sep. 1974

Sep. 1974 289 p refs

(Grant EPA-R-800397)

(PB-241390/4; EPA-650/4-74-045-a; APR-2) Avail: NTIS HC $8.75; HC also available from NTIS $18.00/set of 2 reports as PB-241389-SET CSCL 13B

Progress reports are included by the SRG task groups involved in: the development of mesoscale air pollution related prediction models, modeling of planetary boundary layer (PBL) turbulence and structure, the analysis of acdar signals for wind and

temperature measurements in the PBL, studies of atmospheric aerosol properties and aerosol-atmosphere interactions, and airborne measurements on the urban to mesoscale of atmospheric aerosol, turbulence and radiation. GRA

N75-32620# Pennsylvania State Univ., University Park.
SELECT RESEARCH GROUP IN AIR POLLUTION METEOROLOGY, VOLUME 2 Annual Progress Report, 1 Jun. 1973 - 30 Sep. 1974
Sep. 1974 42 p refs
(Grant EPA-R-800397)
(COM-241391/2; EPA-650/4-74-045-b; APR-2) Avail: NTIS HC $10.50; HC also available from NTIS $18.00/set of 2 reports as PB-241389-SET CSCL 13B

Progress reports are included by the SRG task groups involved in: the development of mesoscale air pollution related prediction models, modeling of planetary boundary layer (PBL) turbulence and structure, the analysis of acdar signals for wind and temperature measurements in the PBL, studies of atmospheric aerosol properties and aserosol-atmosphere interactions, and airborne measurements on the urban to mesoscale of atmospheric aerosol, turbulence and radiation. GRA

N75-32621# Combustion Power Co., Inc., Menlo Park, Calif.
LSW-500 DISPOSAL OF AIR FORCE LIQUID WASTES Final Report, Apr. 1973 - Jun. 1974
Apr. 1975 144 p refs
(Contract F29601-73-C-0128; AF Proj. 683M; AF Proj. 2103) (AD-A010429; AFWL-TR-74-70) Avail: NTIS CSCL 13/12

Presented are the results of a feasibility investigation on thermal degradation of selected USAF liquid wastes in a fluidized bed incineration system. Aircraft washrack wastes, paint stripping wastes, herbicide orange, petroleum, oil and lubricant wastes (POL), municipal garbage and sewage sludge were used for testing in Combustion Power Company's 3-foot diameter (LSW-500) fluid bed combustor. Results show that with proper liquid waste injection locations and procedures POL wastes or shredded and air classified municipal garbage can be used as fuel to dispose of non-fuel liquid wastes without requiring supplemental fuel. When using solid waste as fuel to dispose of liquid waste or when using limestone to control HCl an additional particulate emission control device downstream of the first and second stage inertial system will be required. Combustion Power Company is presently developing a dry scrubber for this purpose. GRA

N75-32622# Argonne National Lab., Ill.
POTENTIAL TRACE ELEMENT EMISSIONS FROM THE GASIFICATION OF ILLINOIS COAL Final Report
N. F. Sather, W. M. Swift, J. R. Jones, J. L. Beckner, J. H. Addington, and R. L. Wilburn Feb. 1975 22 p refs Prepared in cooperation with Peabody Coal Co., St. Louis, Mo. Sponsored by Ill. Inst. for Environ. Quality, Chicago
(IIEQ Proj. 80.026)
(PB-241220/3; IIEQ-75-08) Avail: NTIS HC $3.25 CSCL 07A

Results of comprehensive trace element analyses of samples of Illinois no. 5 and no. 6 seam coals and the unquenched ashes obtained from gasification of these coals in a Lurgi reactor are reported and discussed. Areas where additional background information is needed for assessment of the environmental impact of trace element emissions from coal gasification are identified. GRA

N75-32623# Environmental Technology Assessment, Inc., Oak Brook, Ill.
POWER FACILITY SITING IN THE STATE OF ILLINOIS. PART 2: ENVIRONMENTAL IMPACTS OF LARGE ENERGY CONVERSION FACILITIES Final Report
D. R. MacFarlane, B. M. Hoglund, P. A. Roberts, and J. J. Yates Mar. 1975 312 p refs
(PB-241496/9; IIEQ-75-03) Avail: NTIS

Technical information required for a rational approach to evaluating the environmental impact of large energy facilities such as power plants and coal gasification plants is provided. A set of evaluative tools is given which will allow environmental impacts, costs and benefits to be quantified in a way which should expedite rational decisions concerning alternative energy facility sites. The information presented also provides guidelines for applicants required to submit environmental impact statements. GRA

N75-32624# Smithsonian Institution, Cambridge, Mass. Center for Short-lived Phenomena.
DIRECTORY OF EPA, STATE AND LOCAL ENVIRONMENTAL QUALITY MONITORING AND ASSESSMENT ACTIVITIES Final Report
John W. Scotton, Kevin T. Mullen, John Whitman, and Robert Citron Dec. 1974 385 p
(Contract EPA-68-01-2442)
(PB-241757/4; EPA-600/4-75-001) Avail: NTIS HC $10.25; HC also available from SOD CSCL 13B

The directory describes state and local environmental quality monitoring programs of the United States. It also includes the Environmental Protection Agency's (EPA) national programs and systems which collect, analyze and evaluate these data. It will be useful as a reference and a guide to more detailed information. GRA

N75-32625# Kellogg (M. W.) Co., Houston, Tex.
SULPHUR COMPOUND EMISSIONS OF THE PETROLEUM PRODUCTION INDUSTRY
Dec. 1974 170 p refs
(Contract EPA-68-02-1308)
(PB-241261/7; EPA-650/2-75-030) Avail: NTIS HC $6.25 CSCL 13B

Results are presented of a study of sulfur compounds emissions from the Permian Basin and the Smackover Formation, areas that represent about 80% of the sulfur emissions from oil and gas fields in the U.S. Estimations are given of sulfur dioxide and hydrogen sulfide emissions per year. The plants studied are listed and the production of sulfur emissions is tabulated by countries. GRA

N75-32626# Rutgers Univ., New Brunswick, N.J. Center for Urban Policy Research.
THE CONTRIBUTION OF URBAN PLANNING TO AIR QUALITY Final Report
George Hagevik, Daniel Mandelker, and Richard Brail Feb. 1974 478 p refs
(Contract EPA-68-02-0278)
(PB-241795/4; EPA-450/3-75-038) Avail: NTIS HC $12.00 CSCL 13B

The relationship of air pollution to land use planning is examined. Emphasis is placed on the land use planning implications of the 1970 Clean Air Amendments. Major topics are (a) the potential role of land use controls under the Clean Air Act of 1970, (b) the Vermont and Maine comprehensive land use statutes--an analysis of procedures, (c) administrative review procedures for relating land use planning to air quality management, (d) buffer zones as a control over air pollution--an application of the eminent domain and zoning powers, (e) selected local controls, (f) the generation of emissions, (g) the dispersion of pollutants, (h) air quality management in California, (i) the controversy over nondegradation, and (j) a perspective on land use controls. GRA

N75-32627# Exxon Research and Engineering Co., Linden, N.J.
EVALUATION OF POLLUTION CONTROL IN FOSSIL FUEL CONVERSION PROCESSES. LIQUEFACTION: SECTION 2. SRC PROCESS Final Report
C. E. Jahnig Mar. 1975 88 p refs
(Contract EPA-02-0629)
(PB-241792/1; GRU.8DJ.75; EPA-650/2-74-009-f) Avail: NTIS HC $4.75 CSCL 07A

Results are given of a review of the Solvent Refined Coal (SRC) process from the standpoint of its potential for affecting the environment. Estimates are included of the quantities of solid, liquid, and gaseous effluents as well as the thermal efficiency of the process. A number of possible process modifications of alternatives are proposed which could facilitate pollution control or increase thermal efficiency. Technology needs are indicated. GRA

N75-32628# Air Products and Chemicals, Inc., Marcus Hook, Pa. Houdry Div.
ENGINEERING AND COST STUDY OF AIR POLLUTION

CONTROL FOR THE PETROCHEMICAL INDUSTRY. VOLUME 4: FORMALDEHYDE MANUFACTURE WITH THE SILVER CATALYST PROCESS Final Report
R. B. Morris, F. B. Higgings, Jr., J. A. Lee, R. Newirth, and J. W. Pervier Mar. 1975 94 p refs
(Contract EPA-68-02-0255)
(PB-242118/8; EPA-450/3-73-006-d-Vol-4) Avail: NTIS HC $4.75 CSCL 07A

This document is one of a series prepared for the Environmental Protection Agency (EPA) to assist it in determining those petrochemical processes for which standards should be promulgated. The manufacture of formaldehyde with the silver catalyst process is included along with an industry description, an engineering description of available emission control systems, the cost of these systems, and the financial impact of emission control on the industry. Also presented are suggested air episode procedures and plant inspection procedures. GRA

N75-32629# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
CRUDE OIL SPILLS RESEARCH. AN INVESTIGATION AND EVALUATION OF ANALYTICAL TECHNIQUES
C. A. Wilson, E. P. Ferrero, and H. J. Coleman Apr. 1975 35 p refs
(PB-242128/7; BM-RI-8024) Avail: NTIS HC $3.75 CSCL 07C

Analytical techniques were investigated and evaluated to assist governmental agencies to select simple, rapid, reliable methods for crude oil spill identification. Six crude oil samples were analyzed to evaluate gas-liquid chromatography, atomic absorption spectrophotometry, infrared spectroscopy, sulfur and nitrogen determinations, mass spectrometry, nuclear magnetic resonance spectroscopy, and ultraviolet spectrophotometry. Samples were studied from various selected fields which are likely to be involved in oceanic transport. Gas-liquid chromatographic analysis, atomic absorption spectrophotometric analysis, and sulfur-nitrogen determinations are recommended as the most useful of the techniques investigated. GRA

N75-32630# Environmental Protection Agency, Washington, D.C. Office of Program Integration.
SCIENTIFIC AND TECHNICAL ASSESSMENT REPORT ON MANGANESE Final Report
Apr. 1975 66 p refs
(PB-242291/3; EPA-600/6-75-002) Avail: NTIS HC $4.25 CSCL 06T

A review and evaluation is presented of the current knowledge of manganese in the environment as related to possible deleterious effects on human health and welfare. Sources, distribution, measurement, and control technology are also considered. Manganese concentrations measured in ambient air averaged 0.1 microgram/cu m (annual) with an maximum of 8.3 microgram/cu m (annual) near a large source. In Norway, a form of pneumonia was attributed to airborne manganese in a community where concentrations were measured at 46 microgram/cu m. Manganese poisoning characterized by progressive central nervous system deterioration has occurred under occupational exposure but apparently not from atmospheric exposure. GRA

N75-32631# Battelle Columbus Labs., Ohio.
POTENTIALLY HAZARDOUS EMISSIONS FROM THE EXTRACTION AND PROCESSING OF COAL AND OIL Final Report
H. E. Lebowitz, S. S. Tam, G. R. Smithson, Jr., H. Nack, and J. H. Oxley Apr. 1975 162 p refs
(Contract EPA-68-02-1323)
(PB-241803/6; EPA-650/2-75-038) Avail: NTIS HC $6.25 CSCL 07A

The report lists potentially hazardous materials which may be associated with the air, water, and solid waste from a refinery, a coke plant, a Lurgi high-Btu gas process, and the solvent refined coal process. Fugitive loss was identified as the major emissions source in the refinery, although its composition is difficult to quantify. Coking is the most offensive of the four processes assessed. Coal gasification may produce materials as dangerous as those from the coke plant, but the former will probably be more contained than coke oven emissions. The environmental impact of coal liquefaction is not well defined; however, liquefaction products will probably be more hazardous than crude oil products, and their refining and utilization will be worse offenders than corresponding petroleum operations. GRA

N75-32632# Voorhees (Alan M.) and Associates, Inc., McLean, Va.
DEVELOPMENT OF A TRIAL AIR QUALITY MAINTENANCE PLAN FOR THE SAINT LOUIS AQMSA Final Report
Dec. 1974 171 p refs
(Contract EPA-68-02-1388)
(PB-241824/2; EPA-450/3-74-052) Avail: NTIS HC $6.25 CSCL 13B

The development of a trial air quality maintenance plan for the St. Louis air quality maintenance study area is documented. This is one of four such trial plans prepared as part of the development and testing of EPA Guidelines for air quality maintenance planning. The four areas include St. Louis, San Diego, Denver, and Baltimore. The study area in this report includes the city of St. Louis and the seven counties in Missouri and Illinois which comprise the St. Louis SMSA. The preparation of this trial plan included the review of existing state implementation plans, emission inventory analysis and projection, air quality analysis and projection, and the formulation of attainment/maintenance strategies for control of particulates, sulfur dioxide, carbon monoxide, and photochemical oxidants. GRA

N75-32633# Southern Research Inst., Birmingham, Ala.
A SURVEY OF TECHNICAL INFORMATION RELATED TO FINE PARTICLE Final Report
Apr. 1975 253 p refs
(PB-242383/8; SORI-EAS-74-351; EPRI-259) Avail: NTIS HC $8.50 CSCL 13B

Information was surveyed on subjects related to fine-particle fly-ash emissions from electric utility power boilers, with special attention to trace elements and other materials associated with fly ash that may affect health when inhaled. Information was obtained on (1) the concentrations and distribution of trace elements in fly ash, (2) the toxicology and epidemiology of fly-ash inhalation, (3) the methods used for measuring the particle-size distribution of fly ash and for determining the contents and nature of trace elements in it, and (4) the effectiveness of emission control devices in the removal of submicron particles of fly ash from flue gas. GRA

N75-32634# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
UPDATING THE NATIONAL EMISSIONS DATA SYSTEM POINT SOURCE INVENTORY Final Report
Nov. 1974 13 p
(Contract EPA-68-02-1001)
(PB-242377/0; EPA-450/3-75-056) Avail: NTIS HC $3.25 CSCL 13B

The Environmental Protection Agency requested and received air pollutant emissions reports from a number of point-source facilities in the states of Illinois, Maryland, Michigan, Minnesota, Ohio, Pennsylvania, West Virginia, and Wisconsin. These data were used to update the National Emissions Data System point source emissions inventory. GRA

N75-32635# Research Triangle Inst., Durham, N.C.
INVESTIGATION OF RURAL OXIDANT LEVELS AS RELATED TO URBAN HYDROCARBON CONTROL STRATEGIES Final Report, Jun. 1974 - Feb. 1975
Mar. 1975 352 p refs
(Contract EPA-68-02-1386)
(PB-242299/6; EPA-450/3-75-036) Avail: NTIS HC $10.00 CSCL 13B

A study was conducted in the Ohio Valley area in 1974 to investigate high rural oxidant concentrations above the NAAQS and their possible relationship to urban hydrocarbons. Data regarding the oxidant, nitrogen dioxide, and hydrocarbon relationships were obtained by sampling from a network consisting of five rural and six urban ground stations and an instrumented aircraft. Gases sampled were ozone, nitrogen oxides, and hydrocarbons. Gas chromatograms of grab samples collected at three rural ground stations near Columbus and during aircraft flights were used to identify hydrocarbon species and possible

tracers indicative of urban-generated pollution. The implication is that the release of hydrocarbons and oxides of nitrogen from anthropogenic or biogenic sources, located in either an urban or rural area, all combine to generate appreciable quantities of ozone over wide areas. GRA

N75-32636# IBM Federal Systems Div., Gaithersburg, Md.
COMPREHENSIVE DATA HANDLING SYSTEM, AIR QUALITY DATA HANDLING SUBSYSTEM (AQDHS-2) PROGRAM DOCUMENTATION AND USER'S GUIDE
Jul. 1974 277 p
(Contract EPA-68-02-0638)
(PB-241798/8) Avail: NTIS HC $8.75 CSCL 13B

The subject data handling system provides air pollution control agencies with the capability to create and maintain their own air quality data base and to retrieve data and generate reports from that data base. Documentation is provided for the computer programs which comprise AQDHS-2. It is also written as a users guide with each program described, input requirements described, field descriptions, etc. The system has a powerful retrieval capability which allows the user to retrieve virtually any piece of data in his file. The user can automatically generate his quarterly air quality progress report in SAROAD format. GRA

N75-32637# IBM Federal Systems Div., Gaithersburg, Md.
COMPREHENSIVE DATA HANDLING SYSTEM, EMISSIONS INVENTORY/PERMITS AND REGISTRATION SUBSYSTEM (EIS/P AND R) PROGRAM: DOCUMENTATION AND USERS GUIDE Final Report, Aug. 1972 - Feb. 1975
Feb. 1975 421 p
(Contract EPA-68-02-0638)
(PB-242161/8; EPA-450/3-74-045-a) Avail: NTIS HC $10.50 CSCL 13B

The Emissions Inventory/Permits and Registration Subsystem provides air pollution control agencies with the capability to create and maintain their own emission inventory and permit or registration data base and to retrieve data and generate reports from that data base. A users guide is provided with each program, input requirements, field descriptions, etc. The system has an extremely powerful retrieval capability which allows the user to retrieve on practically and data field in the master file. The system also allows the user to generate his semiannual quarterly report with a minimum of effort. GRA

N75-32638# EnviroPlan, Inc., Rutherford, N.J.
MAXIMUM SO2 CONCENTRATIONS PRODUCED BY A 1000 MEGAWATT POWER PLANT Final Report
Apr. 1975 75 p refs
(Contract EPA-68-01-2837)
(PB-241756/6; EPA-230/1-75-002) Avail: NTIS HC $4.25 CSCL 13B

The objective of the study was to predict the largest annual average sulfur dioxide (SO2) concentrations, maximum 24-hour SO2 concentrations, and maximum 3-hour SO2 concentrations produced per year by a new modern 1000 megawatt electric power plant that complies with the federal New Source Performance Standards for SO2 emissions from coal-fired power plants. The prediction evidence from this study is intended for use in final decisions by the U.S. Environmental Protection Agency concerning federal standards to be promulgated on the subject of nondegradation of air quality. A total of three plant alternatives for complying with new source standards were examined: the use of a scrubber, the use of a scrubber with reheat of emissions, and the use of low sulfur coal. GRA

N75-32639# Environmental Protection Agency, Washington, D.C. Office of Program Integration.
SCIENTIFIC AND TECHNICAL ASSESSMENT REPORT ON PARTICULATE POLYCYCLIC ORGANIC MATTER (PPOM) Final Report
Mar. 1975 97 p refs
(PB-241799/6; EPA-600/6-75-001) Avail: NTIS HC $4.75; also available from SOD HC CSCL 13B

Sources, distribution, measurement, and control technology are also considered. Results of an extensive literature search are presented. Experiments have shown a number of polycyclic organic compounds to be carcinogenic in animals. Although these same compounds have not been proven to be carcinogenic in humans, evidence strongly suggests that they may contribute to the urban factor. In American males, the urban lung cancer death rate is about twice the rural rate, even after adjustment for differences in smoking habits. Evidence suggests significant differences between specific urban areas across the United States. The bulk of the available data is in terms of Benzo(a)pyrene; so this compound was used as an index on particulate polycyclic organic matter. GRA

N75-32640# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
GUIDELINES FOR AIR QUALITY MAINTENANCE PLANNING AND ANALYSIS. VOLUME 5: CASE STUDIES IN PLAN DEVELOPMENT Final Report
Jan. 1975 154 p refs
(Contract EPA-68-02-1386)
(PB-241800/2; EPA-450/4-74-006-Vol-5; OAQPS-1.2-024-Vol-5) Avail: NTIS HC $6.25 CSCL 13B

Trial Air Quality Maintenance Plans for Baltimore, Denver, San Diego, and St. Louis are presented in digest form. In each digest, the Air Quality Maintenance Area is described in terms of topographic, economic, and air quality characteristics; bases for intergovernmental cooperation are discussed; baseline air quality and emissions inventory are established; emissions are projected for 1975, 1980, and 1985 and consequent air quality is estimated. Strategies for insuring the attainment/maintenance of air quality during the decade 1975-1985 are proposed. Problems encountered and possible solutions are discussed. GRA

N75-32641# East Tennessee State Univ., Johnson City. Dept. of Health Science.
EVALUATION OF HEALTH HAZARDS ASSOCIATED WITH SOLID WASTE/SEWAGE SLUDGE MIXTURES Final Environmental Protection Technology Series
William L. Gaby Apr. 1975 56 p refs
(Contract EPA-68-03-0128)
(PB-241810/1; EPA-670/2-75-023) Avail: NTIS HC $4.25; also available from SOD HC CSCL 13B

The report summarizes and evaluates the health hazards associated with municipal solid waste/sewage sludge composition by the windrow composting process. The occurrence and survival of pathogens, parasites, and indicator bacteria at various stages during the composting process are described. The study shows that windrow temperatures of 120F to 167F (49C-74C) maintained for at least seven days destroy pathogens and human parasites. Dog parasitic ova, however, remain intact 35 days after exposure. Considerable variation in the temperature is found at the top and bottom two inches of the windrow indicating that proper turning of the compost is essential to ensure destruction of pathogens and parasites. It is concluded that a properly composed solid waste or solid waste/sewage sludge mixture is microbiologically acceptable as a soil conditioner for gardens, farms, and lawns, or for filling areas of erosion without creating health hazards. GRA

N75-32642# Boating Industry Associations, Chicago, Ill.
ANALYSIS OF POLLUTION FROM MARINE ENGINES AND EFFECTS ON THE ENVIRONMENT, SOUTHERN LAKES Final Report, Apr. 1971 - Apr. 1973
H. L. Davis and K. D. Wilson Jun. 1975 244 p refs Prepared in cooperation with Environ. Sci. and Eng., Inc.,
(Grant EPA-R-801799)
(PB-242176/6; EPA-670/2-75-063) Avail: NTIS HC $7.50 CSCL 13B

The study was conducted to determine the effects of two-cycle outboard engine emissions on Florida lakes using leaded fuel and drained and drainless engines. Field investigations were performed in three natural lakes of two to ten acres near Gainesville, Florida. One lake was treated with drainless engines and one with engines which drained unburned fuel into the water. The third lake served as a control. Biological components and water quality conditions in the three lakes were monitored by routine standard procedures for a time period of 18 months during which motors were operated at the rate of 2.4 gallons of fuel per million gallons of water per day. GRA

N75-32643# Boating Industry Associations, Chicago, Ill.
ANALYSIS OF POLLUTION FROM MARINE ENGINES AND EFFECTS ON THE ENVIRONMENT Final Report
Jun. 1975 333 p refs Prepared in cooperation with Environ. Control Technol. Corp., Ann Arbor
(Grant EPA-R-801799)
(PB-242175/8; EPA-670/2-75-062) Avail: NTIS HC $9.50 CSCL 13B

The objective of the study was to obtain sufficient laboratory and field data to be able to predict the number of outboard engines which can be operated on any particular body of water without causing adverse effects on the aquatic environment. To achieve this objective four small natural bodies of water were subjected to outboard engine emissions three times greater than saturation (maximum) levels occurring under real world boating conditions. These natural water bodies were stressed at these high levels with outboard engine exhaust emissions for a period of three years. The study showed that there were no dramatic or acute changes in the physical, chemical or biological characteristics of the water or sediments of the test lakes at these high stressing levels. GRA

N75-32644# Boating Industry Associations, Chicago, Ill.
ANALYSIS OF POLLUTION FROM MARINE ENGINES AND EFFECTS ON THE ENVIRONMENT Final Report
Jun. 1975 70 p refs
(Grant EPA-R-801799)
(PB-242177/4; EPA-670/2-75-064) Avail: NTIS HC $4.25 CSCL 13B

The research project involved laboratory and field investigations. To achieve the project objective, four ponds were subjected to outboard engine emissions at a rate calculated to be three times greater than that from saturation boating levels. Some marginal changes in the lakes biota were noted but the differences were such that it is not certain whether they were from natural or stress effects. As a result it was not possible to determine conclusively the precise point at which outboard emissions effect the aquatic environment. Based on the results, it is plausible to conclude, however, that because of the high stress levels employed in this study, outboard motor emissions do not significantly affect aquatic ecosystems. GRA

N75-32645# American Standard, Inc., New Brunswick, N.J.
SUSPENDED SOLIDS MONITOR Final Report, Mar. 1969 - Aug. 1970
John W. Liskowitz, Gerald J. Franey, and Joseph Tarczynski Apr. 1975 48 p refs
(Contract DI-14-12-494)
(PB-241581/8; EPA-670/2-75-002) Avail: NTIS HC $3.75 CSCL 13B

A method for measuring concentration of suspended solids in liquid media, based on depolarization of backscattered polarized light, was developed and instrumented. Feasibility studies and field evaluation of the instrument, using sewage influent, effluent and sludge, showed that there is a specific relationship between concentration of solid particles and polarization ratio. It was also shown that the relationship is independent of size distribution and density of particles, color of particles or solution, sludge consistency, velocity, and build-up of solids on the optical window. The field evaluation results indicate that this instrument provides a continuous instantaneous in situ measurement of suspended solids concentrations in combined sewers and other wastewater flows. GRA

N75-32646# Aerospace Corp., El Segundo, Calif.
A REVIEW OF CONTROL STRATEGIES FOR IN-USE VEHICLES Final Report
J. Meltzer, M. G. Hinton, T. Iura, A. Burke, and L. Forrest Dec. 1974 236 p refs
(Contract EPA-68-01-0417)
(PB-241768/1; ATR-74(7328)-1; EPA-460/3-74-021) Avail: NTIS HC $7.50 CSCL 13B

EPA and various State agencies reviewed technical feasibility, emission reduction effectiveness, and costs associated with implementing various approaches for reducing the emission of air pollutants from automobiles currently in use. These approaches include: inspection/maintenance programs, retrofit programs, and the conversion of in-use vehicles to permit the use of gaseous fuels. The emphasis is on providing emission reduction and cost data that may be useful to the States in evaluating the alternative approaches to in-use vehicle emission control, as those approaches may be applied to their particular air quality requirements. GRA

N75-32647# Aerospace Corp., El Segundo, Calif. Urban Programs Div.
ANALYSIS OF TEST DATA FOR NOx CONTROL IN GAS AND OIL-FIRED UTILITY BOILERS Final Report, 1 May 1973 - 31 Aug. 1974
Owen W. Dykema 31 Aug. 1974 260 p refs
(Grant EPA-R-802366)
(PB-241918/2; ATR-75(7487)-1; EPA-650/2-75-012) Avail: NTIS HC $8.50 CSCL 13B

A large number of emissions, operating conditions, and boiler configuration data from full-scale, multiple-burner electric utility boilers using natural gas and low-sulfur oil fuels were analyzed. The report includes: (1) major combustion process modications resulting in NOx emission reductions; (2) estimates of NOx minima achievable in the boilers studied with current hardware; (3) estimates of most probable longer term hardware and operating condition modifications; (4) general mechanisms for the combustion and flame instabilities; and (5) a list of all of the hardware configurations, operating conditions, and NOx, CO, O2, and CO2 emissions data for 428 tests. GRA

N75-32527 Joint Publications Research Service, Arlington, Va.
STUDY OF THE THERMAL RADIOWAVELENGTH EMISSION OF THE WATER SURFACE COVERED WITH OIL FILM
A. A. Glotov, D. T. Matveyev, V. G. Mirovskiy, M. D. Rayev, V. Yu. Rayzer, I. A. Troitskiy, Ye. A. Sharkov, and V. S. Etkin *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 115-119 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 90-93 (For availability see N75-32517 23-42)

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N75-32648 Pennsylvania State Univ., University Park.
NEUTRAL WINDS AND ELECTRIC FIELDS FROM MODEL STUDIES USING REDUCED IONOGRAMS Ph.D. Thesis
Daniel Edward Baran 1974 144 p
Avail: Univ. Microfilms Order No. 75-19728

A relationship between the vertical component of ion velocity and electron density profiles derived from reduced ionograms was developed. Methods for determining the horizontal component of neutral winds and electric fields are presented which utilize this relationship along with variations of the inclinations and declinations of the earth magnetic field. Seasonal and latitudinal variations of the calculated neutral winds are given which are in general agreement with results from theoretical models and measurements. From the calculated neutral winds a new set of neutral pressure gradients was determined and compared with those generated from several static neutral atmospheric models. The variations between the new pressure gradients and those of the models were found to be as large as those between the models themselves. Calculations of the sensitivity factors relating pressure gradients and neutral winds indicate that mode coupling and harmonic generation are important to studies which assume linearized theories. Dissert. Abstr.

N75-32649 Wisconsin Univ., Madison.
ON THE EFFECTS OF TURBULENT FLUID MOTION IN THE COLLISIONAL GROWTH OF AEROSOL PARTICLES Ph.D. Thesis
Fausto Carlos DeAlmeida 1975 206 p
Avail: Univ. Microfilms Order No. 75-12886

The effect of small scale turbulence on the collisional growth of cloud droplets was investigated. Equations for nonuniform motion of a pair of spherical particles at low Reynolds numbers falling in a viscous turbulent environment were solved. Particle

trajectories were then studied to define the collection kernel function of the stochastic growth equation. A model for simulating turbulent velocity was developed and used to analyze particle motion. Then the collisional problem was approached as one in probability space. A general definition of the collection kernel function was developed to represent both the non-turbulent and turbulent cases. Results indicate that small scale cloud turbulences strongly affects the collisional trajectories of particles of radii R(CH76)30 microns. For radii R>30 microns small changes occur. However for radii between 10 and 30 microns there are large increases in collision efficiencies. Cloud droplet growth curves indicate the striking effect of turbulence on the growth of small cloud droplets. Dissert. Abstr.

N75-32650 Boston Univ., Mass.
MAGNETOSPHERIC SUBSTORMS AND AURORAL PARTICLE PRECIPITATION Ph.D. Thesis
Cherackal Chacko Chacko 1975 127 p
Avail: Univ. Microfilms Order No. 75-20698

Low energy particle data gathered by the ESRO 1A satellite was analyzed. During geomagnetic storms, a gap was found to develop in the latitudinal profiles of electrons and protons precipitating in the early evening. An abrupt termination of particle activity on the poleward side of the precipitation region was observed on the night side during substorms. The main precipitation region on the night side also occasionally develops a low intensity poleward tail during quiet periods. These findings may indicate the formation of a neutral line close to the earth across the geomagnetic tail during substorms and the absence of such a barrier during quiet times. In addition, satellite observations of plasma injection into the inner magnetosphere as early as 18 hours indicate that direct plasma injection extends westward as far as dusk during intense substorms. Dissert. Abstr.

N75-32651 Michigan Univ., Ann Arbor.
MAGNETICALLY ORDERED HEATING IN THE POLAR REGIONS OF THE THERMOSPHERE Ph.D. Thesis
Barry Bissell Hinton 1975 206 p
Avail: Univ. Microfilms Order No. 75-20367

Geomagnetically controlled perturbations in the composition and temperature of the upper atmosphere were studied for magnetically quiet and ordinary days using data from the Neutral Atmosphere Composition Experiment on the OGO-6 satellite. Two mechanisms were considered for producing this effect: heating with an associated free convection and horizontal forced convection driven by ion drag. It is concluded, from study of the experimental data, that the first mechanism is the dominant one. Two one-dimensional models are proposed; these represent complementary approximations of the importance of the horizontal mass flux divergence to the continuity of total mass density. Maps of the horizontal distribution of the column integrated energy input rate were produced from comprehensive global composition data using a selected altitude profile of heating. Global average input rates for this heating were also obtained. It follows that polar heating is extremely significant to globar thermospheric structure. Dissert. Abstr.

N75-32652 Michigan Univ., Ann Arbor.
INFERENCE OF STRATOSPHERIC MINOR CONSTITUENTS FROM SATELLITE LIMB RADIANT INTENSITY MEASUREMENTS Ph.D. Thesis
Raja Krishna Mohan Rao Tallamraju 1975 163 p
Avail: Univ. Microfilms Order No. 75-20462

The determination of stratospheric distributions of water vapor, ozone, methane, carbon monoxide and nitrous oxide from satellite-based infrared radiant intensity measurements was examined. Solar occultation measurements show significant stratospheric tangent path absorption by water, O3, CH4, and N2O. Normally expected errors in atmospheric temperature, pressure and spectral line parameters have little effect on the retrieved profile. Tangent height must be known and can be determined from simultaneous measurements in a CO2 channel. With increasing random noise there is more uncertainty of the detailed structure in the constituent profile. The retrieved profile from horizon emission measurements is sensitive to errors in tangent height and atmospheric temperature. It is preferable to determine temperature and tangent height simultaneously. However, other errors and their effects are normally small. Measurements can be taken many times per orbit without the necessity of solar tracking, and diurnal variations of constituent concentrations can be observed. Dissert. Abstr.

N75-32653 Wisconsin Univ., Madison.
DAYTIME ENHANCEMENT OF ATOMIC SODIUM IN THE UPPER ATMOSPHERE Ph.D. Thesis
Mozaffar Partowmah 1975 163 p
Avail: Univ. Microfilms Order No. 75-16325

Atmospheric sodium abundance was observed with a PEPSIOS spectrometer at Madison, Wisconsin. The enhancement tended to peak around the time of the local noon and decreased away from noon with a seasonally changing rate. Over 3000 direct absorption traces of the bottom of the solar D2 line were recorded during 1971-1974 of which 2889 traces were analyzed and the corresponding abundance values were computed. Abundance versus time of the day indicates the greatest enhancement of e = 2.9 for January and February combined. During the rest of the year e has a value between 1.3 and 2.0 with e = 1.3 occurring around June. Seasonal variation of sodium abundance was also observed. The winter maximum of 7.7 times ten to the ninth power atoms/sq cm occurs in early March and the summer minimum of 2.9 times ten to the ninth atoms/cm2 occurs late in August. Dissert. Abstr.

N75-32654 Michigan Univ., Ann Arbor.
STRUCTURAL INSTABILITY DURING EARTHQUAKES AND ACCELEROGRAM SIMPLIFICATION Ph.D. Thesis
Warren Yung-Ling Wang 1975 307 p
Avail: Univ. Microfilms Order No. 75-20473

A criterion to judge the likelihood of structural collapse due to earthquake was formulated by the phase plane technique. The criterion can be used to measure the safety margin of structures against collapse, and to examine the influence on stability by both the structural and the earthquake characters. Structures which can be modeled as one degree of freedom oscillators with elasto-plastic restoring force were subjected to strong earthquake accelerograms. These structures responded with large deformations and were strained into plastic range. The sufficient condition for structural collapse was formulated into a failure criterion which can be conveniently manifested in a spatial coordinate system. Examples of structural responses near collapse are examined by using the failure criterion and its accuracy is shown. Accelerograms were condensed into four-pulse model accelerograms (model) by a minimization method. The governing parameters of the model result from an iteration process. Dissert. Abstr.

N75-32655 Michigan Univ., Ann Arbor.
ON THE KINETIC ENERGY OF THE DIVERGENT AND NONDIVERGENT FLOW IN THE ATMOSPHERE Ph.D. Thesis
Tsing-Chang Chen 1975 161 p
Avail: Univ. Microfilms Order No. 75-20314

The kinetic energy of horizontal flow in a hydrostatic atmosphere is divided into the kinetic energies of its divergent and nondivergent compounds. The law of conversion between these two energies for large-scale flows in the atmosphere is derived and discussed with balanced and unbalanced models of circulations in the atmosphere. It is shown that the total potential energy is converted into the kinetic energy of the divergent flow which, in turn, is converted into the kinetic energy of the nondivergent flow. These energy conversions are equal in a so-called balanced model, but may differ in a model based on the primitive equations. The analysis shows that the kinetic energy reservoir of the divergent part of the flow may play a quasi-catalytic role in the energy conversion between the total potential energy and the kinetic energy of the nondivergent flow. Dissert. Abstr.

N75-32656*# Control Data Corp., Minneapolis, Minn.
DIURNAL STRATOSPHERIC TIDE IN MERIDIONAL WIND, 30 TO 60 KM, BY SEASON AND MONTHLY MEAN TEMPERATURES, 20 TO 60 KM, AT 80 DEG N AND TO 0 DEG N
G. D. Nastrom and A. D. Belmont 8 Aug. 1975 60 p refs (Contract NAS2-7807)
(NASA-CR-137738; RR-2) Avail: NTIS HC $4.25 CSCL 04A

The diurnal component in meridional wind was observed for

each season at twelve rocket stations. Amplitudes and phases are presented as a function of height-latitude or as vertical profiles. Many of the gross features of the tide persist throughout the year, but as they migrate in height and latitude the amplitude or phase at a given location may undergo large changes with season. Longitudinal variations in the diurnal tide are found in the mid-stratosphere, and it is suggested they are coupled with longitudinal variations in the tropospheric temperature structure. Author

N75-32657*# Control Data Corp., Minneapolis, Minn. Research Div.

PERIODIC ANALYSIS OF TOTAL OZONE AND ITS VERTICAL DISTRIBUTION

R. W. Wilcox, G. D. Nastrom, and A. D. Belmont 8 Aug. 1975 66 p refs

(Contract NAS2-7807)

(NASA-CR-137737; RR-3) Avail: NTIS HC $4.25 CSCL 04A

Both total ozone and vertical distribution ozone data from the period 1957 to 1972 are analyzed. For total ozone, improved monthly zonal means for both hemispheres are computed by weighting individual station monthly means by a factor which compensates for the close grouping of stations in certain regions of latitude bands. Longitudinal variability show maxima in summer in both hemispheres, but, in winter, only in the Northern Hemisphere. The geographical distributions of the long term mean, and the annual, quasibiennial and semiannual waves in total ozone over the Northern Hemisphere are presented. The extratropical amplitude of the annual wave is by far the largest of the three, as much as 120 m atm cm over northern Siberia. There is a tendency for all three waves to have maxima in high latitudes. Monthly means of the vertical distribution of ozone determined from 3 to 8 years of ozonesonde data over North America are presented. Number density is highest in the Arctic near 18 km. The region of maximum number density slopes upward toward 10 N, where the long term mean is 45 x 10 to the 11th power molecules cm/3 near 26 km. Author

N75-32658# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE PHYSICS OF ATMOSPHERIC OZONE

A. Kh. Khrgian 1975 267 p refs Transl. into ENGLISH from Mono. Fiz. Atmosfernogo Ozona (Leningrad), 1973 Sponsored in part by NSF

(TT-74-50027) Avail: NTIS HC $8.50 CSCL 04A

Contents: Historical introduction; physical properties of ozone; measurement of ozone amount, ground optical methods; high-altitude and chemical methods of ozone observation; theory of the photochemical equilibrium of ozone; vertical distribution of ozone in the stratosphere and mesosphere; tropospheric and ground-level ozone; total ozone amount; ozone and synoptic processes; analytic investigations of ozone circulation in the atmosphere; effect of ozone on the structure and motion of the atmosphere. GRA

N75-32659# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

EXTREME ESTIMATIONS IN GEOTHERMY AND GEOCRYOLOGY

A. A. Sharbatyan and P. A. Shumskii Dec. 1974 144 p refs Transl. into ENGLISH from mono. Ekstremalnye Otsenki v Geotermi i Geokriologii (Moscow), 1974 p 1-122

(AD-A009695; CRREL-TL-465) Avail: NTIS CSCL 08/7

The monograph is devoted to extremal estimations of the variation in temperature and phase states of water in the lithosphere's upper layer. The author analyzes the changes in a normal geotemperature field under various climatic tendencies and estimates a climatic correction to the geothermal gradient in classical form without consideration of sediment accumulation, denudation and hydrogeologic factors. Calculated are the critical parameters of stationary and non-stationary cryolithic zones. The history of its development in the north of the Western Siberian Lowland is discussed. GRA

N75-32660# Lamont-Doherty Geological Observatory, Palisades, N.Y.

RESEARCH DIRECTED TOWARD THE USE OF LONG AND INTERMEDIATE PERIOD SEISMIC WAVES FOR THE IDENTIFICATION OF SEISMIC SOURCES Semiannual Technical Report, Jul. - Dec. 1974

Robert Tatham Feb. 1975 16 p refs

(Contract F19628-71-C-0245)

(AD-A009635; AFCRL-TR-75-0116; SATR-7) Avail: NTIS CSCL 08/11

Continuing research on the anomalous event problem has placed these events in a particular tectonic setting. The location of the anomalous events is associated with the termination of the tectonic trends of the Himalayas, and the intersection of these trends with the northern extension of the Ancaman-Burman arc. Thus, the tectonic regime of the anomalous events is not part of the Himalayas, but rather appear to be related to end-effects at the eastern terminus of the Himalayas. Further, the thick crust of the Tibetan Plateau, almost twice that of normal continental crust, probably plays a significant role in the occurrence of seismic events with anomalously low surface-wave amplitudes. The thick crust not only offers a medium for the occurrence of earthquakes of moderate focal depth, but also provides a waveguide for the efficient propagation of Love waves and higher-mode Rayleigh waves. GRA

N75-32661# Naval Postgraduate School, Monterey, Calif.

MODELING AN INPUT-OUTPUT GEOKINETIC SYSTEM UTILIZING A FINITE ELEMENT APPROACH M.S. Thesis

Robert Charles Foos Mar. 1975 80 p refs

(AD-A009567) Avail: NTIS CSCL 20/11

The modeling research presented in this paper of an input-output geokinetic system can be applied to problems not only in earthquake research but also to problems in siloed missile systems. The finite element technique provides an effective methodology for exploring the detailed surface movements of the earth in response to ocean tidal loading. The finite element computer program used in this paper was especially designed for analyzing deformations and strains resulting from a system of loads applied to a structure. Relationships are explored between surface loads and fault zone tilt response as a function of fault zone shear strength, and distance of the fault from the load. GRA

N75-32662# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

ICE THICKNESS OBSERVATIONS, NORTH AMERICAN ARCTIC AND SUBARCTIC, 1970-1971, 1971-1972.09 SPECIAL REPORT, PART 7

Michael A. Bilello and Roy E. Bates Apr. 1975 110 p refs (DA Proj. 4A1-61102-b-52E; DA Proj. 4A1-62131-A-894)

(AD-A010329; CRREL-SR-43-Pt-7) Avail: NTIS CSCL 08/12

The seventh in a series of reports on lake and river ice and land-fast sea ice presents ice thickness measurements observed throughout the North American Arctic and subarctic during the 1970-71 and 1971-72 winter seasons. Information on surface ice conditions, dates of first ice, freeze-over and breakup, and detailed measurements of ice thickness across Alaskan rivers are also included. Some reports from the Alaska National Guard network on ice thickness measurements in remote areas of western Alaska are also presented. Analyses were made of maximum observed ice thicknesses reported during the two winters, and deviations from the mean ice thickness measured across rivers and creeks in southeast Alaska between 1965 and 1972. GRA

N75-32663# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

COMPUTER PROGRAM FOR THE DISTURBED STEADY-STATE NIGHTTIME D-REGION Environmental Research Papers

William Swider and Carol I. Foley 13 Mar. 1975 28 p refs (AF Proj. 6690)

(AD-A010412; AFCRL-TR-75-0150; AFCRL-ERP-501) Avail: NTIS CSCL 04/1

A computer program has been developed for the nighttime D-region under disturbed steady-state conditions. The program provides for the determination of the electron concentration, total negative ion concentration, and the individual positive ion concentrations as a function of altitude. Model results are computed and compared with nighttime data obtained by various experimentalists during the 2 to 5 November 1969 solar proton event. GRA

N75-32664# Defence Research Establishment Ottawa (Ontario).
ICE DRIFT IN ROBESON CHANNEL AS DETERMINED USING TELEVISION MOVING TARGET CIRCUITRY
I. H. S. Henderson and F. Paquet Mar. 1974 18 p ref
(AD-A010397; DREO-TN-74-3) Avail: NTIS CSCL 08/12

The movement of ice flows in Robeson Channel was followed over a one-week period during August 1973 using television moving-target circuitry from a cliffside base 350 m above sea level. The basis of the method was to subtract a current TV picture from a video tape recording of the same scene made some time previously, the difference imagery being displayed on a monitor. The TV camera was aimed to produce coincidence of a reference point selected near the center of the pre-recorded imagery, and the changes in azimuth and elevation recorded. From these, ice drift velocities were calculated. GRA

N75-32665# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
ESTIMATION OF EARTHQUAKE RISK, 1 JUN. 1972 - 30 JUN. 1974 Final Report
6 Jan. 1975 59 p refs
(Grant NOAA-N22-163-72(G))
(COM-75-10574/2; NOAA-75041410) Avail: NTIS HC $4.25 CSCL 08K

Statistical modeling of earthquake occurrences is studied. First a statistical method of detecting dependent events and aftershocks using spatial and temporal information was developed and applied to Japan and California earthquake catalogs. The statistical properties of the catalogs without dependent events were examined, in particular with respect to the Poisson process. Also, for modeling of earthquake and aftershock occurrences a compound Poisson-Markov process was examined. The model was simulated on a computer using a random number generator. Catalogs generated in this way departed from the real catalog in only one manner, namely that large aftershocks inhibit rather than trigger subsequent aftershocks. GRA

N75-32666# West Indies Univ., Kingston (Jamaica).
PROCEEDINGS OF THE 4TH INTERNATIONAL SYMPOSIUM ON EQUATORIAL AERONOMY Final Report
Ebun Oni Dec. 1973 910 p refs Proc. held at Ibadan, Nigeria, 4-11 Sep. 1972
(Grant AF-AFOSR-2314-72; AF Proj. 4643)
(AD-A010222; AFOSR-74-0161TR) Avail: NTIS CSCL 04/1

The report contains 88 illustrated abstracts of papers presented at the 4th International Symposium on Equatorial Aeronomy. Topic areas include; D region and below; Solar and luna tidal variations; Ionospheric current systems, electric fields geomagnetic variations and micropulsations; Pogo satellite (results); E region; F region; Studies of equatorial scintillation and topside ionosphere; Airglow. GRA

N75-32667# Texas Instruments, Inc., Dallas. Equipment Group.
STUDY OF TWO AUTOMATIC SHORT-PERIOD SIGNAL DETECTORS. TECHNICAL REPORT NO. 9: VELA NETWORK EVALUATION AND AUTOMATIC PROCESSING RESEARCH
Stephen S. Lane 6 Dec. 1974 32 p refs
(Contract F08606-74-C-0033; ARPA Order 2551)
(AD-A007043; TI-ALEX(01)-TR-74-09) Avail: NTIS CSCL 17/10

The Fisher detector and conventional power detector have been implemented on short-period data recorded at the Korean Seismic Research Station. It was found that false alarm rates varied so widely from day to day that no comparison between detectors could be made. However, a comparison between detectors with different integration times but the same false alarm rate revealed that integration time does not affect the probability of detection. GRA

N75-32668# Ohio State Univ., Columbus. Dept. of Geodetic Science.
TESSERAL HARMONIC COEFFICIENTS AND STATION COORDINATES FROM SATELLITE OBSERVATIONS BY COLLOCATION
Klaus-Peter Schwarz Dec. 1974 48 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-A009629; DGS-217; SR-22; AFCRL-TR-74-0641) Avail: NTIS CSCL 08/5

The usual formulation of the least squares collocation method requires the inversion of matrices with dimensions equal to the number of observations. Such a procedure poses difficult numerical problems when large numbers of observations are involved. It is shown in this report how this difficulty can be overcome. The size of the matrices to be inverted can be reduced to the number of unknown quantities, i.e. the amount of numerical work will be the same as for the corresponding adjustment problem. Numerical questions as the treatment of orbital parameters, the determination of the speed of convergence, the stability of different solutions, and the choice of a covariance function are discussed. The determination of tesseral harmonic coefficients from a combination of satellite and gravimetric data is treated in some detail and the results are related to previous work. GRA

N75-32669# Utah State Univ., Logan. Center for Research in Aeronomy.
IONOSPHERIC MODELING Final Report
L. R. Megill 30 Jun. 1974 17 p
(Contract N00014-67-A-0220-0004; ARPA Order 2266)
(AD-A010205) Avail: NTIS CSCL 04/1

Discussed is the development of a theoretical computer-oriented model of the polar ionosphere between the heights of 50 and 500 km. The model is comprehensive enough to predict both the quiet and disturbed polar ionospheric conditions. GRA

N75-32670# Texas Instruments, Inc., Dallas. Equipment Group.
VELA NETWORK EVALUATION AND AUTOMATIC PROCESSING RESEARCH Quarterly Report, 1 Dec. 1974 - 31 Mar. 1975
Stephen S. Lane 31 Mar. 1975 15 p
(Contract F08606-75-C-0029; ARPA Order 2551)
(AD-A010219; TI-ALEX(01)-QR-75-01; QR-1) Avail: NTIS CSCL 17/10

The quarterly report summarizes the progress made during the period from 1 December 1974 to 31 March 1975 on the VELA network. The five tasks of the program are: evaluation of the Korean seismic research station; investigation of signal detection techniques; investigation of signal estimation techniques; investigation of discrimination techniques; and system engineering studies. GRA

N75-32671# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.
[VARIOUS METHODS OF SEISMIC WAVE DETECTION, INCLUDING ILLIAC-4 PROGRAMMING] Quarterly Technical Summary Report, Oct. - Dec. 1974
R. A. Hartenberger 15 Jan. 1975 28 p refs
(Contract F08606-74-C-0006; ARPA Order 1620)
(AD-A009334; SDAC-TR-74-23) Avail: NTIS CSCL 17/10

The report summarizes the scientific work accomplished at the Seismic Data Analysis Center (SDAC) in the period October through December 1974. During the quarter, eight technical reports covering six subjects were approved for distribution to the government approved list. Three of the reports (TR-74-16, 17, and 18) describe the programming and processing experience with the ILLIAC IV computing system, while Report TR-74-4 describes a new source theory for complex earthquakes. Two reports are comparative in nature: The first, TR-74-5 compares LASA's Detection Processing System with that of NORSAR's; the second, TR-74-6 is an empirical comparison of the two-segment maximum likelihood frequency-wavenumber (f-k) spectra with the f-k spectra produced by beamforming in the frequency domain. Studies of average P and PKP codas and of an iterative beam processor are documented in Reports 305 and TR-73-7, respectively. GRA

N75-32672# Photometrics, Inc., Lexington, Mass.
DATA REDUCTION AND AURORAL CHARACTERIZATION ICECAP. HAES REPORT NUMBER 4 Final Report, 17 Aug. 1972 - 17 Aug. 1974
I. L. Kofsky, J. W. Meriwether, Jr., and J. W. Schroeder 17 Sep. 1974 338 p refs
(Contract DNA001-73-C-0027)

(AD-A009340; PhM-110-74; DNA-3511F) Avail: NTIS CSCL 04/1

This is a report on Photo Metrics: contributions to the Infrared Chemistry Experiments - Coordinated Auroral Program in the period 17 Sep 72 - 17 Aug 74. It presents ICECAP rocket and ground support data reduced and partially analyzed, procedures and computer programs for further application of program data to understanding radiations from the artificially-disturbed atmosphere, characterizations of the auroral ionosphere into which the rocket experiments were launched and critiques of the instruments, background information for planning related coordinated aurora experiments, and some interpretation of program results. GRA

N75-32673# Army Electronics Command, White Sands Missile Range, N. Mex.

BOUNDARY LAYER DUST OCCURRENCE, 1: ATMOSPHERIC DUST OVER THE WHITE SANDS MISSILE RANGE, NEW MEXICO AREA

B. D. Hinds, R. F. Kimberlin, III, and G. B. Hoidale Apr. 1975 72 p refs

(DA Proj. 1T1-61101-A-91A)

(AD-A010335; ECOM-DR-75-2) Avail: NTIS CSCL 04/2

The report provides an overview of published and some previously unpublished data on atmospheric dust over the White Sands Missile Range, New Mexico area. The survey encompasses the occurrence of dusty conditions, the effect of the dust on the propagation of electromagnetic and acoustic energy, and per se properties of the dust. Data on the occurrence of blowing dust and dust storms at the White Sands and Holloman Weather Stations are tabularized. Published data on the propagation effect, refractive index, composition, number concentration and size distribution are summarized in an appendix by means of annotated references. GRA

N75-32674# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF EXCITING TRANSVERSE WAVES IN SEISMIC PROSPECTING OPERATIONS

G. V. Vedernikov 18 Nov. 1974 23 p refs Transl. into ENGLISH from Apparatura, Metodika i Interpretatsiya Geofizicheskikh Nablyudenii (USSR), no. 5, 1971 p 29-42

(AD-A003101; FTD-MT-24-2385-74) Avail: NTIS CSCL 08/11

The method of transverse waves in seismic prospecting has a number of advantages in comparison with the method of longitudinal waves. Explosive methods of excitating transverse waves by which the directed effect of an explosion is created and used were tested. This wide testing of explosive sources became possible with the introduction of the method of selecting seismic waves according to the principle of polarization, when the longitudinal waves excited during explosions are successfully suppressed by the subtraction of the notations of differently directed explosions, during which transverse waves, undergoing inversion, add themselves up, while longitudinal waves cancel each other out. GRA

N75-32675# Lancaster Univ., Bailrigg (England).

IONOSPHERIC RESPONSE TO SOLAR ECLIPSE Final Report

Arthur N. Hunter 30 Jun. 1974 8 p refs

(Grant AF-AFOSR-2544-73; AF Proj. 9767)

(AD-A010509; EOARD-TR-75-1) CSCL 04/1

Four stations were installed in Southern and Eastern Africa to observe Faraday rotation of signals from the geostationary satellite Intelsat IIF3 over a period of about 10 days including the solar eclipse of 30 June 1973. It was intended to investigate eclipse induced gravity waves which theory had suggested to be expected. In agreement with other observers, any such gravity waves were at less than 10% of the expected amplitude and were not observed. GRA

N75-32676# Lowell Technological Inst. Research Foundation, Mass.

ARTIFICIALLY INDUCED SPORADIC E Scientific Interim Report

Klaus Bibl and Bodo W. Reinisch Apr. 1975 38 p refs

(Contract F19628-73-C-0033; AF Proj. 62101F)

(AD-A010442; LTIRF-373/IP; AFCRL-TR-75-0205; SIR-1-2) Avail: NTIS CSCL 04/1

Ionospheric disturbances induced by chemical releases from high altitude rockets were monitored by Digisonde and Doppler-drift observations. The ionogram recordings provide the basic information on the ionospheric layers in terms of vertical electron density profiles. The Doppler-drift observations lead to the determination of the ionospheric structure and drifts. GRA

N75-32677# Manila Observatory (Philippines).

SOLAR EFFECTS ON GEOMAGNETIC MICROPULSATIONS AND VLF PHASE SHIFTS

Victor L. Badillo, Jose E. Salcedo, and Raul A. Panotes 23 Mar. 1975 12 p refs

(Contract F19628-73-C-0035; AF Proj. 4643)

(AD-A010438; SR-1; AFCRL-TR-75-0202) Avail: NTIS CSCL 04/1

Geomagnetic pulsations are short period and small amplitude fluctuations of the earth's magnetic field. The relation is determined between the solar radio dekameter bursts and geomagnetic micropulsations, both of which are associated with solar emission of particles. GRA

N75-32678# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.

NEAR SURFACE ELECTRICAL PROPERTIES OF ROCKS AS A GUIDE TO MECHANICAL PROPERTIES Final Report, 1 Jan. 1972 - 31 Dec. 1974

Theodore R. Madden 31 Dec. 1974 72 p refs

(Contract F19628-72-C-0182; AF Proj. 7639)

(AD-A010058; AFCRL-TR-75-0179) Avail: NTIS CSCL 08/7

Field and laboratory studies were undertaken to study the relationship between the electrical and mechanical properties of rocks. It was found that modest jointing and faulting have a pronounced effect on the seismic properties, but that the electrical properties continue to be controlled by the microscopic cracks even with quite severe faulting. This is explained by the small aspect ratio of joints, the importance of surface conductivity with very narrow cracks and the great increase of the small crack population produced by mechanical stresses. Theoretical studies of random networks were made to explore the conductivity-porosity relationships of porous media. It was shown that the wide range of crack widths existing in rocks can account for the observed relationship. These studies were also extended to explore other mixing laws observed with heterogeneous media. GRA

N75-32679# Naval Research Lab., Washington, D.C.

IMPROVED MODEL TO STUDY PROTON DEPOSITION IN THE ATMOSPHERE

J. E. Rogerson Apr. 1975 30 p refs

(DNA Proj. NWET-HY633-06; NRL Proj. H02-35)

(AD-A010515; NRL-MR-3042) Avail: NTIS CSCL 04/1

A one-dimensional model based on a continuous slowing down approximation is used to study proton deposition in the atmosphere. A dipole geomagnetic field is assumed, and a three constituent atmospheric model is adopted. The effects of hydrogen atoms created by charge exchange processes with atmospheric gases are included, and secondary electron processes are taken into account. Calculations of ionization rates as functions of altitude for several incident proton energies are made and compared to the results of similar calculations using a different method. GRA

N75-32680# Mission Research Corp., Santa Barbara, Calif.

AMBIENT ELECTRON DENSITY PROFILES FROM HIGH ALTITUDE NUCLEAR EFFECTS CHEMISTRY CODES Topical Report, 1 Jan. - 30 Sep. 1974

Jane A. Keefer 14 Feb. 1975 39 p refs

(Contract DNA001-74-C-0171)

(AD-A009941; MRC-R-145; DNA-3520T) Avail: NTIS CSCL 04/1

Daytime electron density profiles for ambient conditions were computed over the range 60-250 km by adding a solar ionizing source to existing nuclear effects chemistry codes. The computed profiles are in satisfactory agreement with experimental data over most of this altitude range. GRA

N75-32681# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
STRONG MOTION EARTHQUAKE ACCELEROGRAMS DIGITIZED AND PLOTTED DATA. VOLUME 1: UNCORRECTED ACCELEROGRAMS. PART T: ACCELEROGRAMS IT274 THROUGH IT293
A. G. Brady and D. E. Hudson Jan. 1975 228 p refs
(Grant NSF GI-28098)
(PB-241943/0; EERL-73-25-Vol-1-Pt-T) Avail: NTIS HC $7.50 CSCL 08K

Records are presented from the El Centro, California, site in the basement of the Imperial Valley Irrigation District substation from 1938 to 1966. Nine groups of aftershocks of the May 18, 1940 Imperial Valley earthquake are included. GRA

N75-32682# Computer Corp. of America, Cambridge, Mass.
DATA COMPUTER SUPPORT OF SEISMIC DATA ACTIVITY Annual Technical Report, 22 Apr. - 31 Dec. 1974
30 May 1975 12 p
(Contract MDA903-74-C-0227; ARPA Order 2613)
(AD-A010235) Avail: NTIS CSCL 08/11

The purpose of the project is to support the ARPA-NMRO Seismic Data Activity by providing data storage and retrieval services. The Arpanet will be used as the communication channel. As part of the service, seismic data will be (a) collected from the Arpanet; (b) stored; and (c) made available to computers on the Arpanet in a convenient and timely manner. The activity on the project to date has been primarily in two areas: hardware acquisition and coordination with the seismic community. GRA

N75-32519 Joint Publications Research Service, Arlington, Va.
GLOBAL MERIDIONAL SECTIONS OF THE UPPER LAYERS OF THE ATMOSPHERE
S. S. Gaygerov, B. P. Zaychikov, M. Ya. Kalikhman, and V. V. Fedorov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 11-20 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 11-17 (For availability see N75-32517 23-42)

N75-32520 Joint Publications Research Service, Arlington, Va.
MEASURING THE AEROSOL CHARACTERISTICS AND DENSITY OF THE ATMOSPHERE BY LASER RADAR
V. M. Zakharov, O. K. Kostko, and V. S. Portasov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 21-28 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 18-23 (For availability see N75-32517 23-42)

N75-32523 Joint Publications Research Service, Arlington, Va.
EFFECT OF MOSCOW ON THE INTEGRAL TRANSPARENCY OF THE ATMOSPHERE
G. M. Abakumova and Z. P. Semenova *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 47-57 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 38-45 (For availability see N75-32517 23-42)

N75-32540 Uppsala Ionospheric Observatory (Sweden).
THE SOUNDING ROCKET PROGRAMME DURING THE IMS AT UPPSALA IONOSPHERIC OBSERVATORY
B. Holback *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 43-45 refs (For availability see N75-32532 23-42)

N75-32541 Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
WAVES AND WAVE-PARTICLE INTERACTIONS IN THE MAGNETOSPHERE: A REVIEW
R. Gendrin *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 47-83 refs (For availability see N75-32532 23-42)

N75-32542 Appleton Lab., Slough (England).
PLASMAS OF THE MAGNETOSPHERE
D. A. Bryant and A. D. Johnstone (Univ. Coll., London) *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 85-102 refs (For availability see N75-32532 23-42)

N75-32543* California Univ., La Jolla.
PLASMA CLOUDS AND AURORAL ARCS
S. DeForest and R. Judge *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 103-123 refs (For availability see N75-32532 23-42)
(Contracts NAS5-10364; NAS5-21055; Grant NGL-05-005-007)

N75-32544 Alberta Univ., Edmonton. Inst. of Earth and Planetary Physics.
STUDIES OF MAGNETIC SUBSTORMS USING GROUND-BASED, BALLOON, ROCKET AND SATELLITE OBSERVATIONS
G. Rostoker *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 125-140 refs Sponsored by Can. NRC (For availability see N75-32532 23-42)

N75-32549 European Space Operations Center, Darmstadt (West Germany).
DATA HANDLING DURING THE IMS
K. G. Lenhart *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 175-180 ref (For availability see N75-32532 23-42)

N75-32550 Technische Hochschule, Graz (Austria). Space Research Inst. of the Austrian Academy of Sciences.
AURORAL ZONE X-RAY MEASUREMENTS WITH BALLOON-BORNE INSTRUMENTS AS A PART OF THE GEOS PROJECT
G. Kremser *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 181-186 refs (For availability see N75-32532 23-42)

N75-32551 Bergen Univ. (Norway). Dept. of Physics.
EXPERIENCES WITH TELEMETRY AND LOCALISATION OF BALLOONS DRIFTING FROM SCANDINAVIA TO GREENLAND, WITH SUGGESTIONS FOR CO-ORDINATED CAMPAIGNS DURING THE GEOS PERIOD
H. Trefall *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 187-193 refs (For availability see N75-32532 23-42)

N75-32552 Bern Univ. (Switzerland).
PROPOSAL FOR A NEW TYPE OF ION TRACER EXPERIMENT USING AN ION MASS SPECTROMETER AT THE GEOSTATIONARY ORBIT
D. T. Young *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 195-200 refs (For availability see N75-32532 23-42)
(Grant SNSF 2.080.73)

N75-32553 Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
SOUNDING ROCKET EXPERIMENTS FOR DETAILED STUDIES OF MAGNETOSPHERIC SUBSTORM PHENOMENA
W. Stuedemann and K. Wilhelm *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 201-204 (For availability see N75-32532 23-42)

N75-32554 Appleton Lab., Slough (England).
PROPOSED UK HIGH-LATITUDE ROCKET CAMPAIGN IN LATE 1976/EARLY 1977
G. R. Thomas and D. A. Bryant *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 205-210 refs (For availability see N75-32532 23-42)

N75-32556 Uppsala Ionospheric Observatory (Sweden).
PROPOSED RELEASE EXPERIMENT TO STUDY IONOSPHERIC-MAGNETOSPHERIC COUPLING
G. Holmgren *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 217-220 refs (For availability see N75-32532 23-42)

N75-32557 Liege Univ. (Belgium). Inst. d'Astrophysique.
A ROCKET-BORNE SPECTROMETER FOR HIGH-RESOLUTION STUDIES OF ATMOSPHERIC EMISSIONS
M. Henrist, R. Duysinx, J. Jamar, and J. P. Macau *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Empahsis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 221-224 refs (For availability see N75-32532 23-42)

N75-32560 Technische Hochschule, Graz (Austria). Space Research Inst. of the Austrian Academy of Sciences.
ION PRODUCTION AND THE EFFECTIVE ELECTRON LOSS COEFFICIENT IN A RELATIVISTIC ELECTRON PRECIPITATION (REP) EVENT
T. A. Jacobsen, M. Friedrich, and W. Riedler *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 239-246 refs (For availability see N75-32532 23-42) (Grant ACSR-1448)

N75-32561 Norwegian Defence Research Establishment, Kjeller.
RESONANCES AND NONLINEARITIES OBSERVED IN A WAVE EXPERIMENT ON A MOTHER-DAUGHTER ROCKET
K. Folkestad, J. Troeim, and J. Bording (Trondheim Univ.) *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 247-254 refs Sponsored partly by Roy. Norweg. Council for Sci. and Ind. Res. (For availability see N75-32532 23-42)

N75-32562 University Coll., London (England). Mullard Space Science Lab.
TIME-DEPENDENT EFFECTS OF A PARALLEL ELECTRIC FIELD
A. D. Johnstone *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 255-260 refs Original contains color illustrations (For availability see N75-32532 23-42)

N75-32563 Appleton Lab., Slough (England).
ENERGY AND ANGULAR DISTRIBUTION OF AURORAL PARTICLES RESULTING FROM TIME-VARYING ACCELERATION
D. S. Hall and D. A. Bryant *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 261-266 refs (For availability see N75-32532 23-42)

N75-32564 Kiruna Geophysical Inst. (Sweden).
COMPARISON OF LIGHT EMISSIONS AND AURORAL PARTICLES IN A POST-BREAK-UP AURORA
R. Lundin and L. E. Andersson *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 267-277 Sponsored in part by Swed. Nat. Sci. Res. Council and Swed. Board for Tech. Develop. (For availability see N75-32532 23-42)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N75-32683 British Library Lending Div., Boston Spa (England).
FEATURES OF LONG TERM MONTHLY MEAN 500 mb HEIGHT FIELDS FOR THE NORTHERN HEMISPHERE
[1974] 19 p refs Transl. into ENGLISH from Tr., Gidromet. Nauch. Issled. Cent. SSSR (USSR) v. 93, 1972 p 59-77 (BLL-M-23551-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Some characteristics of the long-period monthly mean values of 500 mb height are discussed along with seasonal fluctuations of the upper planetary frontal zone and the circumpolar vortex. The mean latitudinal values of 500 mb height were computed, and charts of iso-anomalies were constructed. M.J.S.

N75-32684 State Univ. of New York, Albany.
MICROMETEOROLOGICAL CHARACTERISTICS OVER A THERMAL EFFLUENT Ph.D. Thesis
Warren George Mumford 1975 81 p
Avail: Univ. Microfilms Order No. 75-19568

Meteorological measurements were made above a thermal effluent near Oswego, New York on Lake Ontario. An inhomogeneity in both temperature and roughness exists on the lake surface at that point. A small, instrumented mast was positioned in the lake near the discharge. Fluctuating air temperature and three components of turbulent wind were measured at the two meter level with a fast response thermocouple and a sonic anemometer. Mean profiles of wind and dry and wet bulb temperatures were also measured on the tower. A moveable, floating probe recorded air and water temperatures in the vicinity of the plume. Sensible heat transfer from the plume was measured using the eddy flux technique. The time traces of vertical wind and temperature show that many buoyant elements are present over the plume. These elements are shown to be very effective in the transport of heat and momentum from the water surface. Dissert. Abstr.

N75-32685*# National Aeronautics and Space Administration, Washington, D.C.
SATELLITE GATHERS WEATHER DATA FROM SENSORS ON BALLOONS
17 Oct. 1975 5 p
(NASA-News-Release-75-271) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8756, Baltimore/Washington International Airport, Md. 21240 CSCL 04B

The collection of meteorological, oceanographic, and ice data by Nimbus-6 from floating platforms is briefly described. F.O.S.

N75-32686# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE TENTH SESSION OF THE JOINT ORGANIZING COMMITTEE Global Atmospheric Research Programme
1974 40 p refs Conf. held at Budapest, 13-19 Nov. 1974 Prepared jointly with Intern. Council of Sci. Unions
Avail: NTIS HC $3.75; WMO, Geneva

Progress accomplished to date in a number of the programs making up the Global Atmospheric Research Program (GARP) is reported. These programs include the Numerical Experimentation Program, the Garp Atlantic Tropical Experiment (GATE), the Global Experiment (FGGE), the Air-Mass Transformation Experiment (AMTEX), the GARP Monsoon Sub-Program (MONEX), the GARP Polar Sub-Program (POLEX), and the GARP Climate Dynamics Sub-Program. Future activities are also discussed. ESRO

N75-32687# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE FIRST SESSION OF WMO EXECUTIVE COMMITTEE INTERGOVERNMENTAL PANEL ON THE FIRST GARP GLOBAL EXPERIMENT
1975 83 p Conf. held at Geneva, Oct. 1974 Prepared jointly with Intern. Council of Sci. Unions
(GARP-Spec-Rept-14) Avail: NTIS HC $4.75; WMO, Geneva

The scientific objectives of the First GARP Global Experiment (FGGE) are outlined and the observing system for the experiment described. The basic components of the system include polar-orbiting and geostationary meteorological satellites, constant altitude balloons, and drifting buoys. The data management system for the experiment is noted and the role of other GARP experiments during this experiment is discussed. The time schedule is given and an overall review of national contributions to the experiment is presented. ESRO

N75-32688# Institute for Acoustical Research, Miami, Fla.
THE SURFACE METEOROLOGICAL SUBSYSTEM (SMSS): PRE-GATE CALIBRATIONS AND OPERATIONS MANUAL Final Report, 1 Sep. 1973 - 31 Dec. 1974
Kenneth L. Echternacht Mar. 1975 98 p refs
(Contract N00014-74-C-0177)
(AD-A009423; IAR-75001) Avail: NTIS CSCL 04/2

Part I of the report: Pre-GATE Calibration of the Surface Meteorological Subsystem (SMSS) Sensors SAM and Non-SAM Recorded, presents an overview, outlining the calibration procedures used. Part II entitled - Operations Manual for the Automated Boom and Standard Surface Meteorological and Radiation Sensors and Related Hardware - is the revised version of the document used during the GATE international experiment. The edition includes those changes in the operational procedures and hardware used during the main field experiment. GRA

N75-32689# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE FLUCTUATIONS OF THE WIND FIELD OVER THE TROPICAL INDIAN OCEAN M.S. Thesis
Gary Ward Bryant Mar. 1975 66 p refs
(AD-A009924) Avail: NTIS CSCL 04/2

Using radiosonde data from six widely scattered stations in the Indian Ocean, an attempt was made to identify quasi-periodic wind oscillations during the 1973-1974 winter monsoon season. The data were analyzed using spectrum analysis and time cross-section analysis techniques. In general, the results of the power spectra computed show a seven-day peak which seems most significant. A four-five day peak and a thirteen-day peak were also found at some stations. The cross-spectrum analysis shows little correlation of the peaks, indicating uncertainty in the significance of the spectral results. GRA

N75-32690# Naval Postgraduate School, Monterey, Calif.
AN EVALUATION OF THE HARBOR OF YOKOSUKA, JAPAN AS A TYPHOON HAVEN M.S. Thesis
Russell John Graff Mar. 1975 108 p refs
(AD-A009572) Avail: NTIS CSCL 04/2

The following characteristics of the Port of Yokosuka were discussed: topographical effects on winds during the passage of tropical cyclones, port facilities, wave action and storm surge. Problems to be considered when remaining in port and possible evasion procedures for ships sortieing are examined. Tropical cyclone tracks from 1947-1973 for the western North Pacific were analyzed to determine the probability of threat to the port. Observations by the author and conversations with harbor authorities are utilized in arriving at conclusions. In most instances the results show that the port of Yokosuka is a safe typhoon haven. GRA

N75-32691# Naval Postgraduate School, Monterey, Calif.
SPECTRAL ESTIMATES OF MARINE TURBULENCE DATA M.S. Thesis
Allan Bruce Lund Mar. 1975 62 p refs
(AD-A009575) Avail: NTIS CSCL 04/2

Velocity and temperature fluctuations from multi-level measurements in the marine boundary layer were examined to determine the validity of present formulations and prediction techniques. Spectral distributions were analyzed using an analog analyzer. In general, the height variations of the dissipation rate of turbulent kinetic energy, momentum flux, and the temperature structure parameter observed in this study agree with the overland expressions developed by Wyngaard. Most deviations from expected results were attributed to apparent anomalies in spectral results. GRA

N75-32692# Environmental Prediction Research Facility (Navy), Monterey, Calif.
A 26-YEAR TIME SERIES OF MONTHLY MEAN WINDS OVER THE OCEANS. PART 1: A STATISTICAL VERIFICATION OF COMPUTED SURFACE WINDS OVER THE NORTH PACIFIC AND NORTH ATLANTIC
Sigurd Erling Larson Mar. 1975 91 p refs
(AD-A010122; ENVPREDRSCHF-Tech-Paper-8-75) Avail: NTIS CSCL 04/2

The increasing interest in long term (inter-annual) weather changes and their relation to processes in the ocean is beginning to illuminate the need for and the lack of long term records of physically significant variables which occur over the vast oceanic regions of the Northern Hemisphere. An attempt is made here to evaluate the accuracy of a hindcast time series of surface wind vector components and speeds for the period of January 1960 through December 1969. The quasi-geostrophic model used to calculate these records is described as well as the twelve-hourly surface pressure data which were used as input. The central moments of the probability distributions of the computed records are compared to those of corresponding time series observed on Ocean Station Vessels. GRA

N75-32693# Army Foreign Science and Technology Center, Charlottesville, Va.
BOUNDARY LAYER OF THE ATMOSPHERE
N. L. Iva. Bysovoi 27 Nov. 1974 21 p refs Translated into ENGLISH from unidentified Russian Journal
(AD-A009465; FSTC-HT-23-1422-72) Avail: NTIS CSCL 04/2

A study has been made of an external bridge thermogradientograph (device which measures and records temperature value differences on the boundaries of a layer). Line diagrams, calculated correlations, dependence of instrument reading on layer temperature and slide-wire resistance, circuit sensitivity and selection of the diagonals for connecting the balancing device were some of the topics presented. A general formula for the true value of temperature difference, the effect of switching connecting lines into the external bridge, tolerances in manufacture, and total error of the instrument were also discussed. GRA

N75-32694# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. INDONESIAN COASTAL MARINE AREAS, VOLUME 5: AREA 29: MELVILLE ISLAND, AREA 30: WEST ARAFURA SEA, AREA 31: EAST ARAFURA SEA, AREA 32: WEST TORRES STRAIT, AREA 33: EAST TORRES STRAIT, AREA 34: GULF OF PAPUA SOUTHEAST
Apr. 1975 485 p
(AD-A009648) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 TDF-11, Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSD Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. GRA

N75-32695# Fleet Weather Central/Joint Typhoon Warning Center, FPO San Francisco, Calif. 96630.
ANNUAL TYPHOON REPORT, 1974 Annual Report, Jan. - Dec. 1974
1974 124 p
(AD-A010271) Avail: NTIS CSCL 04/2

The annual publication reviews the tropical cyclone season in the western North Pacific, Bay of Bengal, and the central North Pacific. A brief narrative is given on each typhoon in the western North Pacific including the best track. Pertinent reconnaissance data used to construct the best tracks are provided. Forecast verification data and statistics for the Joint Typhoon Warning Center are summarized. Research efforts at the Joint Typhoon Warning Center is discussed briefly. GRA

N75-32696# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
THE LOCAL INFLUENCE OF HURRICANES ON STRATOSPHERIC AEROSOLS Final Annual Report, 16 Mar. 1973 - 15 Mar. 1974
James M. Rosen and David J. Hofmann 15 Mar. 1974 21 p refs
(Contract N00014-70-A-0266-0002)
(AD-A010227) Avail: NTIS CSCL 04/1

Recently much attention has been given to the possible pollution of the stratosphere in anticipation of man's invasion into this high-altitude region of the atmosphere. However, very little effort in terms of quantitative measurements has been made to assess the sources of natural stratospheric pollution, which may be so large that man could never compete with them. By

virtue of its size and energy density a well-developed hurricane should be able to influence the distribution of trace constituents in the lower stratosphere, at least locally if not on a global basis. The authors describe the results of the first attempt to determine the influence of a hurricane on the vertical profile of aerosol within a 500 mile radius of the center of the storm. Aerosol profiles were obtained over hurricane Gilda in October of 1973. The results show a relatively clean upper troposphere which has been tentatively attributed to a removal process associated with the storm itself. GRA

N75-32697# Naval Postgraduate School, Monterey, Calif.
CLIMATOLOGICAL MARINE-FOG FREQUENCIES DERIVED FROM A SYNTHESIS OF THE VISIBILITY WEATHER GROUP ELEMENTS OF THE TRANSIENT SHIP SYNOPTIC REPORT Annual Report, 1 Jan. - 31 Dec. 1974
R. J. Renard, R. E. Englebretson, and J. S. Daughenbaugh Apr. 1975 44 p refs
(AD-A010267; NPS-51RD75041) Avail: NTIS CSCL 04/2

The study presents the essentials of a method of synthesizing the visibility-weather group elements of marine synoptic reports into a computerized scheme for the purpose of deriving frequencies of marine-fog occurrence. The program, based on an interpretation of reporting guidelines in the Synoptic Code Manual, uses 16 combinations of present and past weather, and visibility, to identify fog in the reports. The program then objectively assigns the duration of fog for the period represented by each of the reports. A prototype climatology of marine-fog occurrence for July, over the North Pacific Ocean, is derived from application of the method to a ten-year data base (1963-72). Results are compared and discussed in relation to other published coastal and marine-fog climatologies. Diurnal fog frequencies at sea and the compatibility of fog observations from Ocean Weather Stations and transient ships are also treated. The continuing work and its goals are described. GRA

N75-32698# Wyoming Univ., Laramie. Dept. of Atmospheric Science.
HETEROGENEOUS ICE NUCLEATION IN THE PRESENCE OF ALIPHATIC AMINES AND AMMONIA
R. Schnell and G. Vali Dec. 1974 33 p refs
(Contract N00123-72-C-0911)
(AD-A009959; AS113) Avail: NTIS CSCL 04/2

By far the most widely applied principle to deliberate modification of atmospheric precipitation processes has been the creation of additional ice particles in clouds by means of seeding. An alternative approach to modification of cloud processes is the inhibition of ice nucleation activity. There is fairly extensive evidence, mostly from laboratory experiments, that certain vapors can significantly reduce the nucleating abilities of varieties of nucleating materials. The work described in this report was undertaken to expand the background knowledge about such inhibiting processes and to explore the possibilities of applying inhibitors to natural clouds. Three major experimental approaches were employed: (1) the freezing of water droplets containing known amounts of nucleants (freezing nuclei) and additives; (2) the activation of deposition nuclei in a static diffusion chamber; and (3) field tests. GRA

N75-32699# Naval Postgraduate School, Monterey, Calif.
THE INCLUSION OF VERTICAL TURBULENT DIFFUSION, MOISTURE AND TROPOPAUSE IN A NUMERICAL MODEL OF STEADY STATE FRONTS M.S. Thesis
Daniel Francis Glevy Mar. 1975 70 p refs
(AD-A009990) Avail: NTIS CSCL 04/2

The numerical frontogenesis model of Williams is converted to ln p vertical spacing and modified to include a higher upper boundary, tropopause and stratosphere, moisture and variable vertical turbulent diffusion coefficients of momentum and heat. The numerical solutions show more realistic quasi-steady fronts forming within one to two days. These solutions are examined and compared over a range of various boundary value coefficients and various ranges of temperature. GRA

N75-32700# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
OPERATIONAL BENEFITS OF METEOROLOGICAL DOPPLER RADAR Interim Report
Ralph J. Donaldson, Jr., Rosemary M. Dyer, and Michael J. Kraus 21 Feb. 1975 25 p refs
(AF Proj. 6670)
(AD-A010434; AFCRL-TR-75-0103; AFCRL-AFSIG-301) Avail: NTIS CSCL 04/2

A comparison is made between Doppler and conventional radar as a tool in operational forecasting of hazardous weather. Estimates are given of the cost increment of Doppler capability above the basic radar cost. The advantages and limitations of dual-Doppler and multi-Doppler networks are also considered. The evidence leads to the firm conclusion that, for operations in areas subject to the threat of tornadoes, hurricanes, and other damaging windstorms, the cost increment of single-Doppler radar capability is more than justified by its advantages over conventional radar. On the other hand, dual-Doppler capability is not recommended for operational use, although it is an excellent research tool. GRA

N75-32701# Environmental Prediction Research Facility (Navy), Monterey, Calif.
A TROPICAL CYCLONE ANALOG PROGRAM FOR THE SOUTHWEST INDIAN OCEAN
Samson Brand Oct. 1974 20 p refs
(AD-A001271; ENVPREDRSCHF-Tech-Paper-16-74) Avail: NTIS CSCL 04/2

A tropical cyclone analog program for the Southwest Indian Ocean area (SWINJAH74) is described. The program is a statistical computer technique to provide forecasts of Southwest Indian Ocean tropical cyclones from 12-72 hours. The analog program is discussed in terms of its proposed operational use at Fleet Weather Central, Guam, Mariana Islands. GRA

N75-32702# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. INDONESIAN COASTAL MARINE AREAS. VOLUME 6: AREA 35: SOUTHEAST NEW GUINEA, AREA 36: NORTHWEST SOLOMON SEA, AREA 37: ADMIRALTY ISLANDS EAST, AREA 38: NEW IRELAND NORTHEAST, AREA 39: NORTH SOLOMON SEA, AREA 40: SOUTHEAST SOLOMON SEA
Apr. 1975 485 p
(AD-A009965) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSD Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. GRA

N75-32703# Institute for Defense Analyses, Arlington, Va.
ON THE RESPONSE OF HEMISPHERIC MEAN TEMPERATURE TO STRATOSPHERIC DUST: AN EMPIRICAL APPROACH Final Report
Robert C. Oliver Apr. 1975 47 p refs
(Contract DOT-OS-30057)
(PB-242104/8; IDA/HQ-75-17018; P-1094; DOT-TST-75-90) Avail: NTIS HC $3.75 CSCL 04B

The cooling effects of stratospheric dust, and corresponding response times for hemispheric mean temperature changes, are estimated using an empirical approach and a simple time-dependent formulation. The approach couples estimates of stratospheric dust injections by volcanic eruptions to an available record of mean temperature anomalies. The time period examined is 1883-1968. The results strongly suggest that large volcanic eruptions do lead to short-term climatic cooling effects that, with frequent eruptions, would tend to be cumulative. The cooling coefficients and response time found are compared to values developed elsewhere. The apparent climatic significane of stratospheric dust, and the fact that climatic changes involve integrals over time, suggest that long-term records of stratospheric dust, as well as other climate-determining parameters, should be developed and maintained. GRA

N75-32704# Earth Satellite Corp., Washington, D.C.
SEA-SURFACE WIND SPEED ESTIMATES FROM THE NIMBUS 5 ESMR Final Report, May 1974 - Feb. 1975
Romeo R. Sabatini Feb. 1975 62 p refs

(Contract N66856-4120-5501; WF52551713)
(AD-A010541; EPRF-TR-3-75(ESC)) Avail: NTIS CSCL 04/2

A statistical relationship is derived between sea surface winds and the brightness temperatures, T sub B, measured by the Nimbus 5 Electrically Scanning Microwave Radiometer (ESMR) in cloudless areas. The relationship is derived by using wind observations in the Mistral and the Tehuantepecer, two fall wind situations occurring in very different sea surface temperature and atmospheric water vapor environments. The Mistral, off the coast of southern France, is characterized by relatively cold sea-surface temperatures of 12 to 15C and dry atmospheres with about 1 cm. of precipitable water. The Tehuantepecer, off the Pacific coast of southern Mexico is characterized by warm sea surface temperatures of 22 to 28C, and moist atmospheres with about 3 cm. of precipitable water. The data thus provided a wide range of sea surface temperatures and atmospheric water content for deriving an equation relating wind and T sub B. The derived equation expresses the surface winds in terms of T sub B, sea surface temperature, and atmospheric water content, and fits the data with a probable error of 5.1 knots. The equation is used to estimate winds over the western Atlantic during an outbreak of polar air which produced strong winds.

GRA

N75-32521 Joint Publications Research Service, Arlington, Va.
CONDITIONS OF DEVELOPMENT OF CONVECTIVE CLOUDS AND PRECIPITATION IN THE TRADEWIND AND EQUATORIAL ZONES OF THE ATLANTIC OCEAN (ACCORDING TO THE MATERIALS OF THE VOLNA SCIENTIFIC RESEARCH WEATHER SHIP)
S. I. Ponomarenko *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 29-39 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 24-31 (For availability see N75-32517 23-42)

N75-32522 Joint Publications Research Service, Arlington, Va.
RADIOSOUNDING DATA AS A MEANS OF DISCOVERING CLOUD LAYERS
Ye. N. Arabey *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 40-46 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 32-37 (For availability see N75-32517 23-42)

N75-32528 Joint Publications Research Service, Arlington, Va.
ATMOSPHERIC PRECIPITATION AND GROUNDWATER LEVEL ABOVE ALUPKI (SOUTH COAST OF CRIMEA)
V. Ye. Rudakov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 124-127 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 95-97 (For availability see N75-32517 23-42)

N75-32530 Joint Publications Research Service, Arlington, Va.
RESULTS OF COMPARING STANDARD METEOROLOGICAL EQUIPMENT DURING THE GATE-73 EXPEDITION
D. P. Bespalov and R. G. Timanovskaya *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 101-106 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 101-106 (For availability see N75-32517 23-42)

N75-32531 Joint Publications Research Service, Arlington, Va.
PHLOROGLUCINOL, SOME OF ITS PROPERTIES AND THE POSSIBILITIES OF ITS APPLICATION FOR MODIFYING SUPERCOOLED CLOUDS
V. V. Piotrovich *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 152-158 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 111-114 (For availability see N75-32517 23-42)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N75-32705 Michigan Univ., Ann Arbor.
LANGRANGIAN MEASUREMENTS OF CURRENT USING DRIFTING BUOYS AND OMEGA RADIO NAVIGATION
Ph.D. Thesis
Euardo David Michelena 1975 190 p
Avail: Univ. Microfilms Order No. 75-20408

The development of an inexpensive drifting buoy system for Lagrangian current measurement is described. This system utilizes the Omega radio navigation system to determine the successive positions of drifting buoys with attached drogues. Omega signals are received by equipment carried on a remote buoy. The positioning information contained in the phase angle difference between signals from two Omega transmitting stations is relayed to a monitoring station on shore. The Omega lines of position that intersect at the buoy location are determined at the monitoring station by demodulation of the transmissions received from the buoy. The reconstructed signal is then input to an Omega receiver-computer. The position of the buoy is determined by marking on an Omega navigation chart the point of intersection of two lines of position. Successive points on the chart represent the trajectory of the tagged water parcel or a Lagrangian description of the current at the buoys location. Dissert. Abstr.

N75-32706 Michigan Univ., Ann Arbor.
THE USE OF COMPUTER-GENERATED PICTURES TO EXTRACT INFORMATION FROM UNDERWATER ACOUSTIC TRANSFER FUNCTION DATA Ph.D. Thesis
Gerald Norman Cederquist 1975 204 p
Avail: Univ. Microfilms Order No. 75-20310

A fundamental block to the experimental measurement of the time-varying transfer function of an underwater acoustic channel is the necessarily detailed and hence large amount of data involved. Computer-generated pictures are one key to solving this data deluge problem. Data display techniques were developed to scan large amounts of multifrequency, bandpass, underwater acoustic transfer function data in the form of computed generated pictures. Transformations were defined to reveal regions of interest as peaks and edges in the pictures. These regions can be followed both in frequency and in time, gaining insights into propagation which are impossible to glean from single-frequency data. The techniques permit easy separation of propagation variations due to low signal-to-noise ratio from variations due to oceanographic effects. The display techniques, applied to transfer function data collected in the Straits of Florida, revealed new insights into underwater acoustic propagation in that locale. Dissert. Abstr.

N75-32707 California Univ., Los Angeles.
THE DEEP CIRCULATION IN THE NORTHERN NORTH ATLANTIC, WITH ESPECIAL REFERENCE TO THE LABRADOR SEA Ph.D. Thesis
William Dargan Ivers 1975 192 p
Avail: Univ. Microfilms Order No. 75-19625

Isopycnal analysis was refined by the introduction of a variable reference pressure, then applied to the circulation of the northern North Atlantic. The evidence so obtained was then used to estimate a reference level for geostropic shear along five different vertical sections of the area. The sections revealed a large, distorted cyclonic gyre north of the Gulf Stream and Atlantic Current. The discovery of an intermediate-depth oxygen minimum in the Labrador Sea led to reinterpretation of the formation of Labrador Sea water. A weak Baffin Bay overflow into the sea was detected. Anti-cyclonic surface flow was found to overlie deep cyclonic flow in the Rockall Channel, and new evidence for a deep inflow from the Faroe Bank Channel was obtained. A numerical model of return flow from the Gulf Stream east of the Azores shows that it is compatible with the existence of a large saline tongue of Mediterranean water stretching westward. Dissert. Abstr.

N75-32708# Committee on Merchant Marine and Fisheries (U. S. House).
FEDERAL OCEAN PROGRAMS REVIEW
Washington GPO 1974 346 p refs Hearings before Subcomm. on Oceanography of Comm. on Merchant Marine and Fisheries, 93d Congr., 2d Sess., 26 and 29 Mar.; 11 Apr. 1974
(GPO-42-775) Avail: Subcomm. on Oceanography

Testimony regarding the Federal role in the regulation of ocean activities is presented. International law, fishery management, weather modification, offshore energy sources, coastal zone management and environmental protection were considered.

D.M.L.

N75-32709# Rhode Island Univ., Kingston. Graduate School of Oceanography.
OXYGEN AS A QUASI-CONSERVATIVE CONSTITUENT IN DEEP WATERS OF THE EASTERN CARIBBEAN
Robert B. Lorens and Dana R. Kester May 1975 22 p refs (Contract N00014-68-A-0215-0003; NR Proj. 083-165) (AD-A009834; Ref-75-3) Avail: NTIS CSCL 08/10

A simple vertical advection-eddy diffusion model was applied to continuous vertical temperature, salinity, and dissolved oxygen profiles at depths greater than 1000 m in the eastern Caribbean. The continuous profiles were well-suited to vertical modeling because they tightly constrained the selection of the model boundaries and the model parameters. A model in which oxygen was assumed to be a conservative constituent fit the observations to within about 0.06 ml/l. The vertical advection-eddy diffusion parameter was the same at three locations in the Grenada Basin, but it was 50% smaller at the northeast corner of the Venezuela Basin. This analysis provides values for the upward vertical velocity for the vertical eddy diffusion coefficients, and a rate of oxygen consumption. A time of 350 years was calculated for the advection of waters between 2000 m and 1000 m in the eastern Caribbean. GRA

N75-32710# Naval Postgraduate School, Monterey, Calif.
SECOND-ORDER WAVE/BODY INTERACTION M.S. Thesis
Glen Walter Smith Mar. 1975 92 p refs
(AD-A009902) Avail: NTIS CSCL 20/4

The second-order solution of the problem of the interaction of a train or regular waves with a completely submerged, horizontal circular cylinder in finite depth water is presented for the two-dimensional case. The incident wave is developed as a second-order Stokes' wave by use of a perturbation method and the solution of both the first-order and second-order scattering potentials is obtained numerically using the Green's function approach. The hydrodynamic pressure and resulting first-order and second-order force coefficients are determined numerically and presented for various values of water depth, cylinder depth of submergence, and wave length. GRA

N75-32711# Environmental Prediction Research Facility (Navy), Monterey, Calif.
AN EVALUATION OF AVAILABLE WAVE REFRACTION MODELS FOR USE ON THE CDC 3100 COMPUTER
K. Rabe Mar. 1975 31 p refs
(AD-A010234; ENVPREDRSCHF-Tech-Note-18) Avail: NTIS CSCL 08/3

An examination of five wave refraction models from various experiments were examined as to their applicability to Naval problems. Of the five, the Wilson model, Dobson's original model and the University of Delaware Dobson model were examined in detail for a grid encompassing the Columbia River mouth. An evaluation of the results obtained and program running requirements was made to ascertain which model was best suited to operational tasks. It was found that the Delaware-Dobson model was superior to the other two and has been found to compare well with Griswold's model. Recommendations and areas of possible improvement were also noted. GRA

N75-32712# Stanford Univ., Calif. Radioscience Lab.
IN-SITU DECAMETRIC RADAR OBSERVATIONS OF OCEAN-WAVE DIRECTIONAL SPECTRA DURING THE 1974 NORPAX POLE EXPERIMENT Final Report, 1 Dec. 1973 - 30 Nov. 1974
Calvin C. Teague Mar. 1975 43 p refs Sponsored in part by NSF
(Contract N00014-67-A-0112-0080)
(AD-A009434; SU-SEL-75-003; TR-3615-2) Avail: NTIS CSCL 08/3

Multi-frequency decametric surface-wave radar observations of ocean-wave backscatter from the R. V. Thomas Washington during the 1974 NORPAX Pole experiment are described. The equipment installation, experimental techniques, and data processing are discussed. Both stationary and synthetic aperture observations were made. All of the data were obtained under low-wind conditions, usually less than 10 m/s. Stationary observations indicated a moderate amount of first-order line broadening, with the second-order continuum typically 20-30 db below the first-order peak. Multi-wavelength synthetic aperture directional ocean-wave spectra were quite broad, typically 120-180 degrees at the half-power points, with front-to-back ratios of no more than 15 db. GRA

N75-32713# Office of Naval Research, London (England).
JOINT NORTH SEA WAVE PROJECT JONSWAP PROGRESS: AN OBSERVER'S REPORT
F. N. Spiess 9 Apr. 1975 19 p refs
(AD-A010132; ONRL-C-8-75) Avail: NTIS CSCL 08/3

Joint North Sea Wave Project is a cooperative, international effort, begun in 1967, to bring all possible means to bear to study the generation, propagation and decay of ocean surface waves. Briefly reviewed are results of the Joint North Sea Wave Project (JONSWAP) meeting held December 1974. About half of the meeting was devoted to assessing the status of data reduction from the 1973 seagoing program and reviewing related objectives, methods and timing for major analyses and interpretive work. The other half was concerned with proposed summer 1975 sea operations -- objectives, logistic requirements, data analyses, and publication procedures. GRA

N75-32714# Naval Oceanographic Office, Washington, D.C.
ALASKAN AREA 15 - 30-DAY ICE FORECASTING GUIDE Special Publication
G. J. Potocsky Feb. 1975 192 p refs
(AD-A010527; NOO-SP-263) Avail: NTIS CSCL 08/12

Procedures are detailed for preparing 15- and 30-day forecasts of ice edge movement, ice growth, and ice disintegration at Alaskan and other coastal and offshore sites using current ice and prognostic environmental data. A statistical method for forecasting ice edge movement and ice distribution changes is given in this guide since this method has proven most useful and has yielded the best results. Frost degree day, related ice growth, and estimated ice disintegration curves are included for 14 stations. Background data on environmental factors related to growth, drift, and disintegration of sea ice throughout the Alaskan area include 15-day mean, median, and extreme southern and northern positions of the pack ice edge and ranges of the 15-day means covering the 17-year period from 1954 through 1970 for semimonthly periods. GRA

N75-32715# Naval Postgraduate School, Monterey, Calif.
THE RESPONSE OF A TWO LAYER HYDROTHERMODYNAMIC OCEAN MODEL TO A SIMULATED MOVING HURRICANE M.S. Thesis
Stanley Holmes Grigsby Mar. 1975 69 p refs
(AD-A009985) Avail: NTIS CSCL 08/3

The time dependent mixed-layer depth and temperature response of a two-layer hydrothermodynamic ocean model to a moving hurricane model was investigated. The hurricane model was that of Elsberry, Pearson, and Corgnati (1974). The maximum eye radius and hurricane intensity was bounded to isolate ocean reaction from hurricane variance. The ocean model was based on the upwelling model of O'Brien and Hurlburt (1972) in two dimensions and was located along the path of the storm. The momentum and depth equations in this model are treated semi-implicitly. Mechanical and convective mixing was included and was found to be the dominate cause of deepening of the mixed layer and cooling of the ocean surface. Alternating regions of upwelling and downwelling were produced in the wake of the storm as a result of inertial waves caused by the passage of the storm. The cases studied indicated a linear relation between the wavelength and the storm translation speed. GRA

N75-32524 Joint Publications Research Service, Arlington, Va.
ESTIMATING THE HEAT BALANCE ON THE SURFACE OF THE NORTHWESTERN PART OF THE PACIFIC OCEAN AND ITS RELATION TO CURRENTS
L. Ye. Veselova and V. V. Pokudov *In its* Meteorology and Hydrol., No. 6, 1975 (JPRS-65607) 4 Sep. 1975 p 58-64 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 46-51 (For availability see N75-32517 23-42)

N75-32525 Joint Publications Research Service, Arlington, Va.
SEMIANNUAL FLUCTUATIONS OF THE HYDROLOGIC ELEMENTS IN THE OCEAN
V. F. Sukhovey *In its* Meteorology and Hydrol., No. 6, 1975

(JPRS-65607) 4 Sep. 1975 p 65-75 refs Transl. into ENGLISH from Meteorol. Gidrolog. (Moscow), no. 6, 1975 p 52-60 (For availability see N75-32517 23-42)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N75-32716# Advisory Group for Aerospace Research and Development, Paris (France).
BIODYNAMIC RESPONSE TO WINDBLAST
D. H. Glaister, ed. (RAF Inst. of Aviation Med.) Jul. 1975 87 p refs In ENGLISH and partly in FRENCH Conf. held at Toronto, 6 May 1975
(AGARD-CP-170) Avail: NTIS HC $4.75

The specific problem of windblast is considered as it affects human tolerance to high speed ejection. Topics discussed include: prevalence of ejection injury, injury mechanisms, protection, and problems of head restraint and helmet loss. For individual titles, see N75-32717 through N75-32726.

N75-32717 Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF NON-COMBAT EJECTION EXPERIENCE 1968-1973 INCIDENCE, DISTRIBUTION, SIGNIFICANCE AND MECHANISM OF FLAIL INJURY c52
W. Steves Ring, James W. Brinkley, and Frank R. Noyes *In* AGARD Biodyn. Response to Windblast Jul. 1975 8 p refs (For availability see N75-32716 23-51)

The USAF noncombat ejection experience during the period 1968-1973 is reviewed attempting to characterize the incidence, distribution, significance, and mechanism of flail injuries. The overall incidence of flail injury is 7% in which 4% involved injuries of a major type. The distribution of injuries is characterized by (1) an absence of major head and neck flail injury, (2) a predominance of proximal over distal injury, and (3) in marked contrast to earlier data, a slight predominance of upper over lower extremity flail injury. The importance of analyzing the forces acting upon the limbs as well as having a clear understanding of the mechanisms of failure is discussed and the need for improved limb restraints is emphasized. Author

N75-32718 Italian Air Force Military School of Aviation Medicine, Rome.
SURVEY ON BIODYNAMIC RESPONSE TO WINDBLAST IN EJECTIONS: PATHOGENETIC MECHANISM, ANALYSIS AND PREVENTION OF INJURIES c52
Gaetano Rotondo *In* AGARD Biodyn. Response to Windblast Jul. 1975 9 p refs (For availability see N75-32716 23-51)

Injuries caused by windblast during escape by ejection seat from high speed jet aircraft are analyzed along with traumatic injuries suffered by aircrews within the cockpit of aircrafts following accidental loss or sudden opening of the canopy or after its explosion in-flight. The pathogenetic mechanisms of the injuries caused by windblast are examined along with the relative limits of human tolerance and the systems which could be employed and improved to increase human resistance to aerodynamic pressure of the wind. Emphasis is placed on the prevention and reduction of the fatality of these injuries. Author

N75-32719 Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
ACCIDENT STATISTICS RELEVANT TO WINDBLAST c52
R. E. Noble and S. W. Olsen *In* AGARD Biodyn. Response to Windblast Jul. 1975 4 p refs (For availability see N75-32716 23-51)

During the period 1966-1974 injuries were significant problems in ejections from Canadian Forces (CF) aircraft. There were ninety nonfatal ejections. Of these, eight crew members escaped free from injuries, sixty-three received minor injuries, and nineteen received serious injuries. An analysis of the injury patterns indicates that they occurred at both low and high speeds. Specific problems are addressed and recommendations are made to enhance aircrew safety during ejection. Author

N75-32720 Royal Naval Scientific Service, London (England).
PATHO-PHYSIOLOGICAL EFFECTS OF WIND BLAST FROM CONVENTIONAL AND NUCLEAR EXPLOSIONS c52
J. S. P. Rawlins *In* AGARD Biodyn. Response to Windblast Jul. 1975 5 p refs (For availability see N75-32716 23-51)

The patho-physiological effects of wind blast resulting from conventional and nuclear explosions are analyzed and related to the effects of wind blast encountered in high speed aircraft ejections and in airborne aircraft breakup, and to some instances of ground impact. It is suggested that data derived from studies of explosive blast effects may contribute to the analysis of aircraft accidents, and to the development of protective equipment for the crews of high performance aircraft. Author

N75-32721 Centre d'Essais en Vol, Bretigny-sur-Orge (France).
INJURIES OBSERVED FOLLOWING HIGH-SPEED EJECTIONS IN THE FRENCH AIR FORCE [LESIONS OBSERVEES APRES EJECTION A GRANDE VITESSE DANS L'ARMEE DE L'AIR FRANCAISE] c52
R. P. Delahaye (Hopital Begin), B. Vettes, and R. Auffret *In* AGARD Biodyn. Response to Windblast Jul. 1975 8 p refs In FRENCH (For availability see N75-32716 23-51)

A review is presented concerning 256 ejections from French Air Force aircraft at speeds ranging between 0 and 750 knots, that took place between 1960 and 1974. The following overall statistics are given: 47 ejections (18 %) were fatal, while 209 (82 %) were successful. A total of 130 helmets (51 %) and 30 masks (15 %) were lost. In the case of ejections performed at speeds above 400 knots (23 cases), air blast effects increase the severity of injuries to personnel and damage to equipment. The percentage of fatalities remains at 18 %, while the percentage of injured aircrews reaches 78 % (as opposed to an overall percentage of 35 %); 78% of helmets and 40% of masks are lost. Only one pilot landed unhurt. Injuries range from ecchymoses to avulsion of limbs. The above data agrees fairly well with comparable data from other air forces. Three cases are discussed in detail. Transl. by Y.J.A.

N75-32722 Royal Aircraft Establishment, Farnborough (England). Engineering Physics Dept.
WINDBLAST: PROTECTION FOR THE HEAD BY MEANS OF A FABRIC HOOD c54
J. M. Rayne *In* AGARD Biodyn. Response to Windblast Jul. 1975 10 p refs (For availability see N75-32716 23-51)

Wind tunnel experiments and operational experience indicate that current helmets are lost during ejection as a result of windblast. The feasibility is studied of protecting the head from exposure to blast by means of an automatically erected fabric hood. It is shown that such a hood placed over the face of a dummy test subject drapes the head effectively on exposure to blast, and prevents the loss of even simple helmet assemblies up to Mach 1. Author

N75-32723 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
AN ARM RESTRAINT SYSTEM FOR EJECTION SEATS IN HIGH PERFORMANCE AIRCRAFT c54
P. H. R. Gill *In* AGARD Biodyn. Response to Windblast Jul. 1975 4 p refs (For availability see N75-32716 23-51)

A restraint system designed for high performance aircraft from which ejection at high speeds is likely is described. The system evolved comprises a seat portion consisting of two fixed length tapes, and a man portion incorporated into a sleeved life preserver. Each seat tape is enclosed in a fabric tube which allows automatic disconnection of the two portions during emergency ground egress. The system functions on ejection by retracting the arms in a similar manner to leg restraint systems. The development, testing and performance of the system is described. Limited studies have demonstrated that the proposed rate of arm retraction is physiologically acceptable both with the hands on the firing handle and under simulated commanded ejection. The arm restraint tapes can be routed unobtrusively to prevent interaction upon routine cockpit movement during normal flight. The performance of the arm restraint system during ejection tests using dummies is also described. Author

N75-32724 Payne, Inc., Annapolis, Md.
ON PUSHING BACK THE FRONTIERS OF FLAIL INJURY c52

Peter R. Payne *In* AGARD Biodyn. Response to Windblast Jul. 1975 7 p refs (For availability see N75-32716 23-51)

Under combat conditions, limb flail injury in U.S. open ejection seats is shown to be a severe problem. Adequate passive entrapment devices demonstrated in the wind tunnel and adequate seat stabilizing devices also demonstrated in full-scale wind tunnel testing and by air drops are reviewed. An extraction escape system is described which offers hope, not only of avoiding the high speed problems of existing tractor rocket escape systems, but also of substantially reducing system volume, cost, and weight, as well as simplifying the flail injury problem. Author

N75-32725 Payne, Inc., Annapolis, Md.
EXPERIMENTAL EVALUATION OF LIMB FLAIL INITIATION AND EJECTION SEAT STABILITY **c54**
Fred W. Hawker and Anthony J. Euler *In* AGARD Biodyn. Response to Windblast Jul. 1975 17 p refs (For availability see N75-32716 23-51)
(Contract F33615-74-C-4015)

Limb dislodgement forces were determined in free flight simulation of an ejection along with the static stability of the seats/occupant combination. The forces and moments measured with anthropometric dummies and live subjects in identical ejection seats were compared. Results are presented and discussed. Author

N75-32726 Research Inst. of National Defence, Stockholm (Sweden).
HIGH SPEED EJECTIONS WITH SAAB SEATS **c54**
B. O. Andrae, E. Ek, H. Lorin, and B. Ch. R. Stroemblad *In* AGARD Biodyn. Response to Windblast Jul. 1975 5 p ref (For availability see N75-32716 23-51)

The Swedish development work on devices to protect against windblast effects at high speed ejections is surveyed. Examples of past, present, and future solutions are given. The Swedish Air Force Experience with high speed ejections is summarized. Author

N75-32727*# Kanner (Leo) Associates, Redwood City, Calif.
ADMINISTRATION OF ETHANOL IN VARIOUS DOSES: LEVELS OF CEREBRAL SEROTONIN IN RATS
F. Bogetto (Turin Univ.) and E. Torre (Turin Univ.) Washington NASA Oct. 1975 6 p refs Transl. into ENGLISH from Boll. Soc. Ital. Biol. Sper. (Naples), v. 50, 1974 p 1639-1642
(Contract NASw-2790)
(NASA-TT-F-16595) Avail: NTIS HC $3.25 CSCL 06C

Scalar doses of ethanol were administered to Wistar rats to determine whether behavioristic effects of ethanol depend on interaction with cerebral serotonin. The results are expressed in tabular form, and indicate that ethanol has no significant effect on cerebral serotonin levels. Author

N75-32728# Air Force Weapons Lab., Kirtland AFB, N.Mex.
A SEASONAL OCCURENCE CHECKLIST OF WATERFOWL HAZARDOUS TO FLIGHT SAFETY IN SOUTHERN UNITED STATES Final Report, 15 Sep. 1973 - 20 Jun. 1974
Robert C. Beason Mar. 1975 15 p
(AD-A010521; AFWL-TR-74-174) Avail: NTIS CSCL 01/2

Large numbers of overwintering and migratory waterfowl present a serious hazard to USAF low level training missions in the Southwestern U.S. Waterfowl census data from sevel National Wildlife Refuges in the Southwest have been compiled and summarized in occurrence checklists. Comparison of refuge data with the proposed low level training mission will enable one to assess the potential bird-aircraft strike hazard and determine possible adjustments in flight scheduling and/or alternate areas to reduce the hazard. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N75-32729 Yeshiva Univ., New York.
CONDITIONING HUMAN SYSTOLIC PRESSURE: THE STIMULUS DURATION PARAMETER Ph.D. Thesis
Harry K. Wexler 1975 168 p
Avail: Univ. Microfilms Order No. 75-20581

Several subjects were tested to determine blood pressure response to intermittent electrical stimulation. The subjects ranged in age from 17-30 years and showed no history of respiratory or cardiovascular disease. Each subject underwent three sessions of conditioning and one of extinction distributed over two weeks. Shocks occurred during light-on (CS+) periods and never in light-off (CS-) periods. The three groups were (SL, ML and LL) ranked according to time spend in the positive stimulus (CS+) such that SL<ML<LL. There were two control groups that received no shocks. The SL group showed an average +- difference of 2.5 mm Hg, the ML group 0.8mm hg, and the LL group 0.2mm hg. The control groups showed no discrimination. Magnitudes of discrimination appeared to be a parametric function of CS+ duration. A shock density hypothesis (probability of receiving shock during CS+) was formulated. Finally, the results were related to a conditioned fear model of hypertension. Dissert. Abstr.

N75-32730 Fordham Univ., New York.
THE DETERMINATION OF CADMIUM, CALCIUM, COPPER, LEAD, MAGNESIUM, POTASSIUM, SODIUM, AND ZINC BY ATOMIC ABSORPTION SPECTROSCOPY IN THE BRAIN, KIDNEY, AND LIVER Ph.D. Thesis
Robert Charles Messina, Jr. 1975 171 p
Avail: Univ. Microfilms Order No. 75-18891

The concentrations of cadmium, calcium, copper, lead, magnesium, potassium, and zinc were determined for the right, left, caudate, and quadrate lobes of the liver. The concentration of each metal in the kidney was examined from the outer cortex through inner medullary tissue. The white and gray matter of the brain was also analyzed. Samples were ashed at 425 C and diluted to volume. The metal concentrations were then determined with an atomic absorption spectrophotometer. The data was computerized to calculate sample concentrations and a scatter plot was made of concentration vs sample location. Data from the liver was subjected to analysis of variance, the kidney data involved Nth order regression analysis, and a t-test between correlated means was used on the brain data. The results show a nonuniform distribution of metals in the kidney with varying amounts of uniform distribution in the liver and brain. Dissert. Abstr.

N75-32731 California Univ., Santa Barbara.
THE RESPONSE OF A HUMAN TEMPERATURE REGULATORY SYSTEM MODEL IN THE COLD Ph.D. Thesis
Raymond Grey Gordon 1974 259 p
Avail: Univ. Microfilms Order No. 75-19299

A mathematical model of the human temperature regulatory system utilizing finite difference techniques with variable nodal spacing is presented. A cold stress control system which includes a feed-forward controller utilizing the skin temperature and heat transfer rate as disturbances signals is postulated. Model and experimental results are compared for a transient cold exposure, and the results show substantial agreement indicating that heat flux is an input to the temperature regulatory system. Simulation of the cardiovascular system and extremity blood flow agrees with experimental data which has not been done by other models before. The model includes new anatomical and basal physiology information with more detail than previous models. The effect of nodal spacing on the calculated temperatures is also analyzed. The finite difference calculations of the transient radial temperature distribution in living tissue are compared with an analytical solution in which metabolism, blood flow rate, and arterial blood temperature vary with time. Dissert. Abstr.

N75-32732*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 144
Aug. 1975 86 p refs
(NASA-SP-7011(144)) Avail: NTIS HC $4.00 CSCL 06E

This bibliography lists 257 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1975. Author

N75-32733*# Oak Ridge Associated Universities, Tenn.
STUDIES RELATIVE TO THE RADIOSENSITIVITY OF MAN: BASED ON RETROSPECTIVE EVALUATIONS OF THERAPEUTIC AND ACCIDENTAL TOTAL-BODY IRRADIATION Final Report
R. C. Ricks, comp. and C. C. Lushbaugh, comp. 1 Sep. 1975 226 p refs
(NASA Order T-88566)
(NASA-CR-144439) Avail: NTIS HC $7.50 CSCL 06R

The radiobiologic studies carried out with joint (AEC) ERDA and NASA support during the years 1964 to 1974 at the Medical Division of Oak Ridge Associated Universities are presented. The physiologic data generated were similar in many ways to those previously observed in other medical radiobiologic experiences. They differed, however, in the methods of data acquisition and analysis. Instead of more conventional analytical methods, pulmonary impedance was recorded and quantitated as a measure of radiation-induced gastrointestinal distress and fatiguability. While refinements in dose response related to gastrointestinal distress were accomplished, it was also found that through the use of Fourier analysis of pulmonary impedance waveform GI distress could easily be recognized and quantified even when the initial stages of nausea were below the subjects subjective level of recognition. The results demonstrate that change in pulmonary impedance waveform closely parallel well-defined stages of GI distress, i.e., initial nausea, a progressive increase in nausea, and finally vomiting episodes. Author

N75-32734*# Baylor Univ., Houston, Tex.
APOLLO GASTROINTESTINAL ANALYSIS Final Report
Buford L. Nichols and C. T. L. Huang 15 Aug. 1975 20 p refs
(Contract NAS9-12728)
(NASA-CR-144437) Avail: NTIS HC $3.25 CSCL 06S

Fecal bile acid patterns for the Apollo 17 flight were studied to determine the cause of diarrhea on the mission. The fecal sterol analysis gave no indication of an infectious diarrhea, or specific, or nonspecific etiology occurring during the entire flight. It is assumed that the gastrointestinal problems encountered are the consequences of altered physiology, perhaps secondary to physical or emotional stress of flight. F.O.S.

N75-32735# Royal Aircraft Establishment, Farnborough (England).
BACK PAINS OF FLYING PERSONNEL. SIXTY-EIGHT CASES OF BACK PAINS OBSERVED IN FLYING PERSONNEL AT THE HOSPITAL MILITAIRE D'INSTRUCTION DOMINIQUE LARREY, VERSAILLES
R. P. Delahaye, R. Pannier, and L. Tabusse Jul. 1975 12 p refs Transl. into ENGLISH from French Conference Report Presented at 11th Intern. Aeronautical and Cosmonautical Medical Congr. (Madrid), 1962
(RAE-Lib-Trans-1844; BR48763) Avail: NTIS HC $3.25

Back pains affecting flying personnel have been classified according to their etiology. Among the most frequent are post-traumatic pains appearing after a more or less considerable length of time following some kind of an accident. Back pains may be due to disc troubles which do not occur until after a considerable lapse of time, hence the necessity for clinical and X-ray checking of all spinal injuries. Muscular insufficiency in the spinal region is another possibility. The second general category of back pains is observed in flying personnel older than 40 years; the clinical signs here are not very different from signs of arthrosis in other, non-flying patients. A third category of back pains is due to posture; this affects helicopter pilots especially, and these are of varying intensity according to the type of helicopter and the nature of missions. Kinetotherapy and corrective calisthenics are recommended. Author

N75-32736*# Scripps Clinic and Research Foundation, La Jolla, Calif.
EFFECTS OF WEIGHTLESSNESS ON TISSUE PROLIFERATION Annual Report, 4 Sep. 1974 - 4 Sep. 1975
William H. Crosby and Mehdi Tavassoli 4 Sep. 1975 28 p
(Contract NAS9-14341)
(NASA-CR-144457) Avail: NTIS HC $3.75 CSCL 06P

The repair of bone marrow stroma following mechanical injury was studied to obtain baseline data for a proposed space experiment regarding the effect of weightlessness on marrow stroma and other proliferating cell systems. Author

N75-32737# Naval Coastal Systems Lab., Panama City, Fla.
GAS CONSUMPTION OF SCUBA DIVERS
M. W. Lippitt, Jr. and G. F. Bond Oct. 1974 66 p
(AD-A009354; NCSL-223-74) Avail: NTIS CSCL 06/19

A series of 6-hour test dives were accomplished to determine the gas consumption rates of divers breathing air from an open circuit demand system for rest, light exercise, and moderate exercise; at water temperatures of 40F, 60F and 80F. Diver dress was the wet suit. The results indicate a significant increase in gas consumption in 40F water for the rest and light exercise activities. The 40F moderate exercise and all exercise levels at 60F and 80F produced values close to those predicted in the U.S. Navy Diving Gas Manual. Only two divers out of six were able to complete the 40F, 6-hour dive. GRA

N75-32738# Medical Coll. of Wisconsin, Milwaukee. Dept. of Environmental Medicine.
SUMMARY RESULTS OF RESEARCH DIRECTED TOWARD ELICITING EFFECTS OF EXPOSURE TO CARBON MONOXIDE ON THE SPONTANEOUS ELECTROENCEPHALOGRAM AND VISUAL EVOKED CORTICAL ELECTRICAL ACTIVITY Final Report
14 Aug. 1974 36 p refs
(Contract CRC-CAPM-3-68)
(PB-242202/0; MCOW-ENVM-CO-74-3; CRC-APRAC-CAPM-3-68-7) Avail: NTIS HC $3.75 CSCL 06P

The spontaneous electroencephalogram (EEG) and the visual evoked cortical electrical activity (visual evoked response, VER) were studied in young adult males to ascertain the effects of exposure to carbon monoxide (CO). The EEG was found to be generally resistant to change during eight hours of exposure at the lower CO concentrations (maximum carboxyhemoglobin saturations of 10 and 22 percent). During the eight hour exposures, the VER was generally resistant to change until COHb levels of 22 percent were achieved, while with 24 hours of exposure changes were evident even at the lowest concentrations (COHb equals 4-10 percent). This change, an increase in VER wave amplitude, suggest that these exposures induced central nervous system depression. GRA

N75-32739# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
ESTIMATES OF INCREASE IN SKIN CANCER INCIDENCE WITH TIME FOLLOWING A DECREASE IN STRATOSPHERIC OZONE Final Report
Pythagoras Cutchis Feb. 1975 33 p refs
(Contract DOT-OS-30057)
(PB-242278/0; DOT-TST-75-91) Avail: NTIS HC $3.75 CSCL 06R

Estimates of skin cancer incidence resulting from a sudden reduction of stratospheric ozone made and based on uncertain epidemiological data are viewed. These estimates are interpreted as saturation values that would not be realized until many decades have elapsed subsequent to the assumed UV perturbation resulting from the ozone reduction. Similarly, many decades are required before skin cancer incidence rate is restored to the unperturbed rate following removal of the perturbing agent. Calculations for the growth of skin cancer incidence with time are made. Skin cancer incidence is assumed to be a linear function of either accumulated lifetime or adult dose, and several step-function models for the UV perturbation are investigated. GRA

N75-32740# Medical Coll. of Wisconsin, Milwaukee. Dept. of Environmental Medicine.
EXPOSURE OF HUMANS TO CARBON MONOXIDE COMBINED WITH INGESTION OF DIPHENHYDRAMINE HYDROCHLORIDE OR PHENACETIN Final Report
14 Aug. 1974 81 p refs Sponsored in part by EPA
(Contract CRC-CAPM-3-68)
(PB-242098/2; MCOW-ENVM-CO-74-1; CRC-APRAC-CAPM-3-68-5) Avail: NTIS HC $4.75 CSCL 06T

The COHb saturation tested was 14 percent (above average for cigarette smokers), while drug doses were those usually

prescribed. No synergistic effects were observed. Three additional observations were made: (1) the occurrence of CO induced headaches at COHb saturations of 14 percent; (2) the possible effect of CO exposure on EEG activity at this level; and (3) the finding that phenacetin, as an analgesic, did not lessen the headaches induced by the CO exposure. GRA

N75-32741# Medical Coll. of Wisconsin, Milwaukee. Dept. of Environmental Medicine.
EXPOSURE OF HUMANS TO CARBON MONOXIDE COMBINED WITH INGESTION OF ETHYL ALCOHOL AND THE COMPARISON OF HUMAN PERFORMANCE WHEN EXPOSED FOR VARYING PERIODS OF TIME TO CARBON MONOXIDE Final Report
14 Aug. 1974 41 p refs Sponsored in part by EPA
(Contract CRC-CAPM-3-68)
(PB-242099/0; MCOW-ENVM-CO-74-2;
CRC-APRAC-CAPM-3-68-6) Avail: NTIS HC $3.75 CSCL 06T

The effects of CO and ethyl alcohol on behavioral test performance were assessed at 24 hour exposure as compared to a 5-1/2 hour exposure to identical concentrations of CO. A dose level of 1.6ml of 100 proof alcohol/kg body weight and a COHb blood level of approximately 14 percent were chosen. The purpose of the study was to test the hypothesis that a 24-hour exposure to low levels of CO would have deleterious effects on behavior and that alcohol would potentiate such effects. The data obtained from tests of coordination, arithmetic, inspection, manual dexterity, time estimation, and vigilance did not provide evidence to substantiate either of these hypothesis. The only positive result was alcohol adversely affects eye-hand coordination. GRA

N75-32742# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF BREATHING 100 PERCENT OXYGEN ON SHORT TERM MEMORY OF MILITARY OFFICERS M.S. Thesis
Richard Alan Marsden Mar. 1975 52 p refs
(AD-A009989) Avail: NTIS CSCL 06/19

Using a serial short term memory task, subjects were required to respond to symbols presented one-back, 2-back, and 3-back from a randomly presented list of four different symbols while breathing either 100 percent oxygen or atmospheric air with an oxygen mask. The purpose of the experiment was to determine whether breathing 100 percent oxygen had an effect on short term memory. Analysis of the data collected from 36 subjects showed that breathing pure oxygen had no effect on the subjects: short term memory ability over a 12 minute period. This result is in direct contrast to previously reported results. GRA

N75-32743# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BIOCHEMICAL RESEARCH IN THE STUDY OF THE TOXICITY OF CHEMICAL SUBSTANCES
O. G. Arkhipova and I. V. Pavlova 12 Nov. 1974 22 p refs Transl. into ENGLISH from Mezhdunarodnogo Seminara Uchenykh Sots. Stran (Moscow), 1970 p 41-49 Seminar held at Moscow, 25-29 Nov. 1968
(AD-A001846; FTD-MT-24-992-74) Avail: NTIS CSCL 06/20

When evaluating biochemical data as indicators of the toxicity of substances and using them for purposes of standardization, it is first of all necessary to bear in mind the biological significance of these indicators, i.e., to determine which metabolic component is disrupted in this case. It is also necessary to bear in mind the degree of manifestation of these changes. Thus, the basic mechanisms of the action of poisons are the changes in the metabolic processes which they cause. They can be revealed with the aid of biochemical procedures and methods. GRA

N75-32717 Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF NON-COMBAT EJECTION EXPERIENCE 1968-1973 INCIDENCE, DISTRIBUTION, SIGNIFICANCE AND MECHANISM OF FLAIL INJURY
W. Steves Ring, James W. Brinkley, and Frank R. Noyes *In* AGARD Biodyn. Response to Windblast Jul. 1975 8 p refs (For availability see N75-32716 23-51)

N75-32718 Italian Air Force Military School of Aviation Medicine, Rome.
SURVEY ON BIODYNAMIC RESPONSE TO WINDBLAST IN EJECTIONS: PATHOGENETIC MECHANISM, ANALYSIS AND PREVENTION OF INJURIES
Gaetano Rotondo *In* AGARD Biodyn. Response to Windblast Jul. 1975 9 p refs (For availability see N75-32716 23-51)

N75-32719 Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
ACCIDENT STATISTICS RELEVANT TO WINDBLAST
R. E. Noble and S. W. Olsen *In* AGARD Biodyn. Response to Windblast Jul. 1975 4 p refs (For availability see N75-32716 23-51)

N75-32720 Royal Naval Scientific Service, London (England).
PATHO-PHYSIOLOGICAL EFFECTS OF WIND BLAST FROM CONVENTIONAL AND NUCLEAR EXPLOSIONS
J. S. P. Rawlins *In* AGARD Biodyn. Response to Windblast Jul. 1975 5 p refs (For availability see N75-32716 23-51)

N75-32721 Centre d'Essais en Vol, Bretigny-sur-Orge (France).
INJURIES OBSERVED FOLLOWING HIGH-SPEED EJECTIONS IN THE FRENCH AIR FORCE [LESIONS OBSERVEES APRES EJECTION A GRANDE VITESSE DANS L'ARMEE DE L'AIR FRANCAISE]
R. P. Delahaye (Hopital Begin), B. Vettes, and R. Auffret *In* AGARD Biodyn. Response to Windblast Jul. 1975 8 p refs In FRENCH (For availability see N75-32716 23-51)

N75-32724 Payne, Inc., Annapolis, Md.
ON PUSHING BACK THE FRONTIERS OF FLAIL INJURY
Peter R. Payne *In* AGARD Biodyn. Response to Windblast Jul. 1975 7 p refs (For availability see N75-32716 23-51)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N75-32744 United States International Univ., San Diego, Calif.
PERSONALITY CHANGE RESULTING FROM WATER SUSPENSION SENSORY ISOLATION Ph.D. Thesis
Mark Kammerman 1975 91 p
Avail: Univ. Microfilms Order No. 75-20251

The problem was to determine whether normal individuals show positive personality change after experiencing water-suspension isolation, and whether the personality changes were stable over a one-month period. A major objective was to place twenty of the thirty volunteers in a water-suspension isolation tank, ten of which would hear an audio message designed to encourage free association. The MMPI was administered pre, post and follow-up to determine significant personality changes. The isolation experience was divided into three immersions, the first lasting one half-hour and the second two lasting one and one-half hours each. The importance of the study derives from three neglected issues: the use of water-suspension isolation in creating personality changes, the use of normal subjects, and the stability of deprivation-induced personality changes over short times periods. Dissert. Abstr.

N75-32745# Royal Aircraft Establishment, Farnborough (England).
SLOW ACTIVITIES EVOKED IN MAN FOLLOWING VOLUNTARY MOVEMENT AND ARTICULATED SPEECH
G. Lelord, F. Laffont, D. Sauvage, and P. Jusseaume Jun. 1975 24 p refs Transl. into ENGLISH from Electroencephalog. Clin. Neurophysiol. (Montreal), v. 35, no. 2, 1973 p 113-124
(RAE-Lib-Trans-1845; BR48764) Avail: NTIS HC $3.25

Experiments were conducted in which the subject was invited to carry out a movement after a stimulus. The stimulus was either a click or, more frequently, a flash of a paired stimulus in which a click was followed by a flash after a 700 msec interval. The phenomenon usually observed is a slow negative wave with a long latency appearing after the movement. This wave is not

restricted to the contralateral motor area but extended bilaterally with a maximum at the vertex. Its characteristics appear to be the same after clenching the fist, different movements of the bucco-lingual region, articulation of a word or even its evocation. The slow waves preceding movement, described by authors studying the anticipation of or preparation for movement, are not usually seen. The conditional slow wave appearing before movement is similar to the contingent negative variation with sharp commands and brisk movements. Author

N75-32746*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HUMAN COMFORT RESPONSE TO RANDOM MOTIONS WITH A DOMINANT LONGITUDINAL MOTION
Ralph W. Stone, Jr. Jul. 1975 88 p refs
(NASA-TM-X-72746) Avail: NTIS HC $4.75 CSCL 05E

Subjective ride comfort response ratings were measured on the Langley Visual Motion Simulator with longitudinal acceleration inputs with various power spectra shapes and magnitudes. The results show only little influence of spectra shape on comfort response. The effects of magnitude on comfort response indicate the appicability of psychophysical precepts for comfort modeling. Author

N75-32747*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A METHOD FOR THE STUDY OF HUMAN FACTORS IN AIRCRAFT OPERATIONS
William Barnhart, Charles Billings, George Cooper, Rob Gilstrap, John Lauber, Harry Orlady, Bert Puskas, and Warren Stephens Sep. 1975 49 p
(NASA-TM-X-62472; A-6237) Avail: NTIS HC $3.75 CSCL 05E

A method for the study of human factors in the aviation environment is described. A conceptual framework is provided within which pilot and other human errors in aircraft operations may be studied with the intent of finding out how, and why, they occurred. An information processing model of human behavior serves as the basis for the acquisition and interpretation of information relating to occurrences which involve human error. A systematic method of collecting such data is presented and discussed. The classification of the data is outlined. Author

N75-32748*# National Bureau of Standards, Washington, D.C.
EMOTIONALITY IN RESPONSE TO AIRCRAFT NOISE: A REPORT OF DEVELOPMENT WORK Final Report
Patsy A. Klaus Washington NASA Oct. 1975 90 p refs
(NASA Order L-88318)
(NASA-CR-2600) Avail: NTIS HC $4.75 CSCL 05E

A literature search and pilot study conducted to investigate the topic of emotional response to aircraft noise are described. A Tell-A-Story Technique was developed for use in the pilot study which required respondents to make up stories for a series of aircraft-related and non-aircraft-related pictures. A content analysis of these stories was made. The major finding was that response patterns varied among three groups of respondents - those currently living near airports, those who had lived near airports in the past, and those who had never lived near airports. Negative emotional feelings toward aircraft were greatest among respondents who had lived near airports in the past but no longer did. A possible explanation offered for this finding was that people currently living near airports might adapt to the situation by denying some of their negative feelings, which they might feel more free to express after they had moved away from the situation. Other techniques used in the pilot study are also described, including group interviews and a word association task. Author

N75-32749*# Massachusetts Inst. of Tech., Cambridge.
PILOT PERFORMANCE IN ZERO-VISIBILITY PRECISION APPROACH Ph.D. Thesis
Arye R. Ephrath Jun. 1975 233 p refs
(Grant NGR-22-009-733)
(NASA-CR-137759) Avail: NTIS HC $7.50 CSCL 05E

The pilot's short-term decisions regarding performance assessment and failure monitoring is examined. The performance of airline pilots who flew simulated zero-visibility landing approaches is reported. Results indicate that the pilot's mode of participation in the control task has a strong effect on his workload, the induced workload being lowest when the pilot acts as a monitor during a coupled approach and highest when the pilot is an active element in the control loop. A marked increase in workload at altitudes below 500 ft. is documented at all participation modes; this increase is inversely related to distance-to-go. The participation mode is shown to have a dominant effect on failure-detection performance, with a failure in a monitored (coupled) axis being detected faster than a comparable failure in a manually-controlled axis. Touchdown performance is also documented. It is concluded that the conventional instrument panel and its associated displays are inadequate for zero-visibility operations in the final phases of the landing approach. Author

N75-32750# Civil Aeromedical Inst., Oklahoma City, Okla.
ATTITUDES ON EN ROUTE AIR TRAFFIC CONTROL TRAINING AND WORK: A COMPARISON OF RECRUITS INITIALLY TRAINED AT THE FAA ACADEMY AND RECRUITS INITIALLY TRAINED AT ASSIGNED CENTERS
John J. Mathews, Bart B. Cobb, and William E. Collins May 1975 38 p refs
(AD-A013343/9; FAA-AM-75-3) Avail: NTIS HC $3.75 CSCL 05/10

Questionnaires concerning aspects of training-related and work-related attitudes were sent to air traffic control (ATC) trainees who represented groups of attritions and retentions in two En Route training programs: programs that provided basic training at the FAA Academy and programs that provided basic training at the trainees' assigned facilities. The following attitudes were assessed: (1) general attitude toward ATC training; (2) attitude of trainees toward academy and facility training, depending on whether academy training preceded or followed facility training; (3) job attitudes held by trainees; and (4) sex differences and attrition-retention differences in these attitudes. Results are presented and discussed. J.M.S.

N75-32751# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
INVESTIGATION OF PILOTS' TRACKING CAPABILITY USING A ROLL COMMAND DISPLAY Technical Report, Feb. - Jun. 1970
Richard Geiselhart, Joseph K. Jarboe, and Paul T. Kemmerling, Jr. Dec. 1971 64 p refs
(AD-A009590; ASD-TR-71-46) Avail: NTIS CSCL 05/9

Ten Air Force pilots having current flying status flew a series of missions to establish baseline normative data for pilot tracking performance. An F-111A flight simulator was used as the test-bed for the experiment. The mission consisted of flying the aircraft simulator at 450 knots and 6000 feet to a designated target while tracking or keeping the bank steering needle centered. Various segments of the mission were designed to measure pilot tracking ability under perturbed and unperturbed conditions. Twenty-seven different evaluation scores were obtained to determine pilot tracking performance. Recommendations are made for further studies on tracking performance as a function of system and pilot constraints. GRA

N75-32752# Arizona State Univ., Tempe. Dept. of Psychology.
VISUAL AND AUDITORY INFORMATION PROCESSING IN FLYING SKILL ACQUISITION Final Report, Jul. 1973 - Jun. 1974
Barry Leshowitz, Stanley P. Parkinson, and Wayne L. Waag Dec. 1974 20 p refs
(Contract F41609-74-C-0002; AF Proj. 1138)
(AD-A009636; AFHRL-TR-74-103) Avail: NTIS CSCL 05/9

The document summarizes a series of experiments conducted to study further refinements in the development of experimental paradigms for the investigation of information processing skills relevant to pilot training. A series of tasks have been developed and studied which attempt to measure the individual's information processing capacity as well as his susceptibility to performance degradation resulting from the introduction of interfering stimuli. Data suggest performance on these tasks to be highly dependent upon individual differences, therefore, making them good candidates for use as tools in the investigation of information

processing skills in flying training. Implications for direct application to flying training research are discussed. GRA

N75-32753# Navy Personnel Research and Development Center, San Diego, Calif.
TRAINING MATHEMATICS SKILLS WITH GAMES Research and Evaluation Report, Jul. 1973 - Dec. 1974
Patrick H. McCann Apr. 1975 24 p refs
(AD-A009364; NPRDC-TR-75-28) Avail: NTIS CSCL 05/9

The goal of this study was to test the efficacy of using games presented on the PLATO IV instructional system to provide remedial mathematics training for Basic Electricity/Electronics (BE/E) School trainees. Two learning tasks which provide the most difficulty for students were selected and instructionally programmed for the PLATO IV system. Drill and practice routines for the two tasks were prepared in three methods. Two games were designed which utilized PLATO IV display capabilities, along with a conventional problem presentation followed by answer feedback routine. A group of students was assigned to each of the counterbalanced order of the independent tasks. Within each group, students received one of the six possible combinations of the three methods (conventional and two games). GRA

N75-32754# Systems Control, Inc., Palo Alto, Calif.
IDENTIFICATION OF THE OPTIMAL CONTROL MODEL FOR THE HUMAN OPERATOR Final Report
Anil Phatak, Howard Weinert, and Ilana Segall May 1975 56 p refs
(Contract F33615-13-C-4021)
(AD-A009956; AMRL-TR-74-79) Avail: NTIS CSCL 05/10

The optimal control model concept appears attractive for modeling human operator behavior in a variety of tasks. However, no successful method has existed in the past for estimating the human operator model parameters from experimental data. Forced attempts at identification have failed because some of the model parameters are not identifiable. In this report, the optimal control model is analyzed with the system identification point of view to determine which parameters can be identified. As a result, a systematic procedure for the identification of the optimal control model parameters from measured experimental data has been developed. This procedure is validated by application to experimental human operator data. GRA

N75-32755# Naval Submarine Medical Research Lab., Groton, Conn.
EYE-MOVEMENTS DURING SEARCH FOR CODED AND UNCODED TARGETS
Saul M. Luria and Mark S. Strauss 28 Jun. 1974 30 p refs
(AD-A002713; NSMRL-787; PR-10) Avail: NTIS CSCL 05/10

Eye-movements and search-time of four subjects were studied as they searched for a target-dial in a 4 x 4 array of dials which were differentiated either by (1) color, (2) shape, (3) a combination of color and shape, or (4) were uncoded. Search-time varied reliably between conditions: it was generally shortest in the color-condition, followed by color-shape, shape, and the uncoded condition. Subjects were capable of using both shape and color simultaneously. Search-time appeared to be strongly associated with the average number of fixations required for target-detection but not with other measures of eye-movements. Other characteristics are also noted. GRA

N75-32756# Air Force Human Resources Lab., Brooks AFB, Tex.
TRYOUT OF A GENERAL PURPOSE SIMULATOR IN AN AIR NATIONAL GUARD TRAINING ENVIRONMENT Interim Report, 1 Jun. - 31 Aug. 1974
Ronald W. Spangenberg Dec. 1974 16 p refs
(AF Proj. 1121)
(AD-A009993; AFHRL-TR-74-92) Avail: NTIS CSCL 05/9

An evaluation of the usability, effectiveness, and acceptance in a job environment was performed on a general purpose simulator using a simulation of a radar system. General purpose simulators permit sharing of a programmable capability among simulations, thus providing economical hands-on training and training not usually economically available by other means. Training and exercises in malfunction isolation were given Air National Guard personnel. Data were obtained using questionnaires, a performance test, and interviews. GRA

N75-32757# Air Force Human Resources Lab., Brooks AFB, Tex.
GROUND TRAINING DEVICES IN JOB SAMPLE APPROACH TO UPT SELECTION AND SCREENING Final Report, Sep. 1972 - Aug. 1974
W. Dean LeMaster and Thomas H. Gray Dec. 1974 59 p refs
(AF Proj. 1123)
(AD-A009995; AFHRL-TR-74-86) Avail: NTIS CSCL 05/9

The purpose of this study was to develop a screening procedure for undergraduate pilot training (UPT). This procedure was based upon the use of ground-based instrument trainers in which UPT candidates, naive to flying, were evaluated in their performance of job sample tasks; i.e., basic instrument flying. Training and testing sessions were conducted in a highly standardized and tightly controlled environment. Student performance was scored using only objective measures of aircraft control and systems management. The job sample approach proved highly successful in predicting student performance in the T-37 phase of UPT. Attrition, due to causes other than a lack of flying skill, was not satisfactorily predicted by this approach. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N75-32758*# Beckman Instruments, Inc., Anaheim, Calif.
AUTOMATED IODINE MONITORING SYSTEM DEVELOPMENT (AIMS) Final Report
Aug. 1975 81 p
(Contract NAS9-14298)
(NASA-CR-144433; FR-1188-101) Avail: NTIS HC $4.75 CSCL 06K

The operating principle of the automated iodine monitoring/controller system (AIMS) is described along with several design modifications. The iodine addition system is also discussed along with test setups and calibration; a facsimile of the optical/mechanical portion of the iodine monitor was fabricated and tested. The appendices include information on shuttle prototype AIMS, preliminary prime item development specifications, preliminary failure modes and effects analysis, and preliminary operating and maintenance instructions. M.J.S.

N75-32759*# Martin Marietta Corp., Denver, Colo.
MANNED MANEUVERING UNIT TECHNOLOGY SURVEY
G. V. O. Cook, ed. 20 Aug. 1975 59 p refs
(Contract NAS9-14593)
(NASA-CR-144444; MCR-75-320) Avail: NTIS HC $4.25 CSCL 05H

The preliminary design of the manned maneuvering unit (MMU) for the shuttle is investigated, and the current state of the art in certain technology areas that may find application on the operational EVA shuttle MMU is examined. Three broad areas of technology, namely: (1) mechanical energy storage - i.e., the practicality of utilizing the energy storage capability of either a reaction wheel or a control moment gyro, (2) numerical and alphanumerical displays, and (3) recent electronics developments such as microprocessors and integrated injection logic, were covered. Author

N75-32760*# AiResearch Mfg. Co., Los Angeles, Calif.
ELECTRICAL DISTRIBUTION SYSTEM (EDS) AND CAUTION AND WARNING SYSTEM (CWS) Final Report
T. McClung 23 Sep. 1975 90 p
(Contract NAS9-14311)
(NASA-CR-144432; AiResearch-75-11994) Avail: NTIS HC $4.75 CSCL 06K

An astronaut caution and warning system is described which monitors various life support system parameters and detects

out-of-range parameter conditions. The warning system generates a warning tone and displays the malfunction condition to the astronaut along with the proper corrective procedures required. Author

N75-32761*# Institute for Research, Inc., Houston, Tex.
FURTHER DEVELOPMENT OF A BIOCIDE GENERATION AND WATER SYSTEM PASSIFICATION SYSTEM ADDENDUM Final Report
18 Apr. 1975 40 p
(Contract NAS9-12998)
(NASA-CR-144434) Avail: NTIS HC $3.75 CSCL 06K

An electrochemical process for generating iodine in situ in a potable water metallic storage system was examined. The degree of concurrent corrosion protection and of metallic ion buildup was determined. A working metal bellows system was evaluated and tested for the buildup of metallic ions comparable to that reported in spacecraft potable water specifications. An integrated system was assembled and tested which may be used to maintain the potability of water which is passively stored in metallic containers for extended periods of time. Test conditions and apparatus are described. Author

N75-32762# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
VEHICULAR CONTROL BY VISUAL FIELD CUES: MODEL DEVELOPMENT AND EXPERIMENTAL VALIDATION
Arthur Grunwald and S. J. Merhav Jul. 1975 38 p refs
Sponsored by Ministry of Defence
(TAE-254) Avail: NTIS HC $3.75

The development and experimental validation of an analytical model for manual visual field control (VFC) of aircraft is presented. A basic model for the control oriented visual field information (VFI) is proposed and formulated in an optimal control framework. A special case of VFC is studied, namely, the manual lateral control of a TV guided remotely piloted vehicle (RPV) along a straight reference trajectory in the presence of side gusts. For experimental validation of five-degree-of-freedom fixed-base simulator was constructed to simulate a RPV flight along a nominally straight reference trajectory. The starting point in the validation program was a VFI model based on error detection at one looking distance, which proved to be correct for fixed distance viewing but not for the complete VFC task. The analytical model was then reformulated to allow VFI detection at two looking distances. This two point VFI model was found to be an adequate representation for the complete VFC task and to match the experimental results closely, thus enabling the determination of the human operator parameters within narrow limits. Author

N75-32763*# LTV Aerospace Corp., Dallas, Tex.
SHUTTLE KIT FREEZER REFRIGERATION UNIT CONCEPTUAL DESIGN Final Report
R. J. Copeland 22 Aug. 1975 85 p refs
(Contract NAS9-9912)
(NASA-CR-144445; T122-RP-044) Avail: NTIS HC $4.75 CSCL 06K

The refrigerated food/medical sample storage compartment as a kit to the space shuttle orbiter is examined. To maintain the -10 F in the freezer kit, an active refrigeration unit is required, and an air cooled Stirling Cycle refrigerator was selected. The freezer kit contains two subsystems, the refrigeration unit, and the storage volume. The freezer must provide two basic capabilities in one unit. One requirement is to store 215 lbs of food which is consumed in a 30-day period by 7 people. The other requirement is to store 128.3 lbs of medical samples consisting of both urine and feces. The unit can be mounted on the lower deck of the shuttle cabin, and will occupy four standard payload module compartments on the forward bulkhead. The freezer contains four storage compartments. Author

N75-32764*# Boeing Aerospace Co., Houston, Tex. Saturn/Apollo/Skylab Branch.
CREW APPLIANCE STUDY Final Report
B. W. Proctor, R. P. Reysa, and D. J. Russell 29 Aug. 1975 131 p refs
(Contract NAS9-13965)
(NASA-CR-144449; D2-118572) Avail: NTIS HC $5.75 CSCL 05/4

Viable crew appliance concepts were identified by means of a thorough literature search. Studies were made of the food management, personal hygiene, housekeeping, and off-duty habitability functions to determine which concepts best satisfy the Space Shuttle Orbiter and Modular Space Station mission requirements. Models of selected appliance concepts not currently included in the generalized environmental-thermal control and life support systems computer program were developed and validated. Development plans of selected concepts were generated for future reference. A shuttle freezer conceptual design was developed and a test support activity was provided for regenerative environmental control life support subsystems. Author

N75-32765*# Hamilton Standard, Windsor Locks, Conn.
ONE MAN ELECTROCHEMICAL AIR REVITALIZATION SYSTEM Final Report, Nov. 1973 - Jun. 1975
John C. Huddleston and John R. Aylward May 1975 136 p refs
(Contract NAS9-13679)
(NASA-CR-144447; SVHSER-6546) Avail: NTIS HC $5.75 CSCL 06K

An integrated water vapor electrolysis (WVE) hydrogen depolarized CO2 concentrator (HDC) system sized for one man support over a wide range of inlet air conditions was designed, fabricated, and tested. Data obtained during 110 days of testing verified that this system can provide the necessary oxygen, CO2 removal, and partial humidity control to support one man (without exceeding a cabin partial pressure of 3.0 mmHg for CO2 and while maintaining a 20% oxygen level), when operated at a WVE current of 50 amperes and an HDC current of 18 amperes. An evaluation to determine the physical properties of tetramethylammonium bicarbonate (TMAC) and hydroxide was made. This provides the necessary electrolyte information for designing an HDC cell using TMAC. Author

N75-32766*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AUTOMATIC FLUID DISPENSER Patent Application
Peter C. Sakellaris, inventor (to NASA) (Oregon Univ. Dental School, Portland) Filed 8 Oct. 1975 17 p Sponsored by NASA
(NASA-Case-ARC-10820-1; US-Patent-Appl-SN-620675) Avail: NTIS HC $3.25 CSCL 06K

An apparatus for dispensing fluid to test animals according to a time schedule is disclosed. Fluid automatically flows to individual dispensing units at predetermined times from a fluid supply and is available only for a predetermined interval of time after which an automatic control causes the fluid to drain from the individual dispensing units. Fluid deprivation continues until the beginning of a new cycle when the fluid is once again automatically made available at the individual dispensing units. NASA

N75-32767*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ACTUATOR DEVICE FOR ARTIFICIAL LEG Patent Application
John L. Burch, inventor (to NASA) Filed 12 Sep. 1975 27 p
(NASA-Case-MFS-23225-1; US-Patent-Appl-SN-612965) Avail: NTIS HC $3.75 CSCL 06B

An actuator device is provided for moving an artificial leg of a person having a prosthesis replacing an entire leg and hip joint. The device includes an articulated hip joint assembly carried by the natural leg and a second articulated hip joint assembly carried by the prosthesis. The energy created from the movement of the natural leg is transferred by a compressible fluid from the first hip joint assembly to the second hip joint assembly for moving the artificial leg. NASA

N75-32768# Applied Psychological Services, Wayne, Pa.
A MODEL FOR PREDICTING INTEGRATED MAN-MACHINE SYSTEM RELIABILITY: MODEL LOGIC AND DESCRIPTION
Arthur I. Siegel, J. Jay Wolf, and Martin R. Lautman Nov. 1974 230 p refs
(Contract N00024-72-C-1277)
(AD-A009814) Avail: NTIS CSCL 05/8

A previously developed man-machine model which is capable of simulating closed man-machine systems operated by crews of from 4 to 20 members was substantially modified so as to allow its use for system reliability and system availability predictive purposes. The resultant new model is capable of generating new system availability and reliability measures based on human and equipment performance resulting from the computer simulation runs. A description of the revised computer model including the changes is presented, together with the model flowchart and user information, and the degree of success in producing rational output achieved during a set of basic runs using the revised model and program is discussed. GRA

N75-32769# Army Natick Labs., Mass.
EFFECT OF STORAGE CONDITIONS ON THE QUALITY OF COMPRESSED FOOD BARS
Abdul R. Rahman, Harold Gorfien, Donald E. Westcott, Glenn Schafer, and David DuBose Dec. 1974 28 p refs
(AD-A006494/9; FEL-28; USA-NLABS-TR-74-64-FEL) Avail: NTIS HC $3.75 CSCL 06/8

Four prototype compressed bars - cherry, beef noodle soup, corn flake and bean salad - were developed in the laboratory. They were then produced by commercial firms and were evaluated in prototype individual ration packets in the field. Storage studies indicate that the average technological ratings for color, flavor, and texture of dry as well as rehydrated bars were not adversely affected after storage for 3, 6, and 12 months at 4, 21, or 38C or for 18 months at 4 or 21C. The ratings of beef noodle soup were somewhat lower than the rest of the bars throughout the storage tests. GRA

N75-32555 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
A SURVEY OF ATTITUDE-CONTROL AND RECOVERY SYSTEMS FOR THE CURRENT GERMAN SOUNDING ROCKET PROGRAMME
E. Krieg *In* ESA European Sounding Rocket and Sci. Balloon Activity at High Latitudes, with Emphasis on the Intern. Magnetospheric Study (IMS) Feb. 1975 p 211-215 (For availability see N75-32532 23-42)

N75-32722 Royal Aircraft Establishment, Farnborough (England). Engineering Physics Dept.
WINDBLAST: PROTECTION FOR THE HEAD BY MEANS OF A FABRIC HOOD
J. M. Rayne *In* AGARD Biodyn. Response to Windblast Jul. 1975 10 p refs (For availability see N75-32716 23-51)

N75-32723 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
AN ARM RESTRAINT SYSTEM FOR EJECTION SEATS IN HIGH PERFORMANCE AIRCRAFT
P. H. R. Gill *In* AGARD Biodyn. Response to Windblast Jul. 1975 4 p refs (For availability see N75-32716 23-51)

N75-32725 Payne, Inc., Annapolis, Md.
EXPERIMENTAL EVALUATION OF LIMB FLAIL INITIATION AND EJECTION SEAT STABILITY
Fred W. Hawker and Anthony J. Euler *In* AGARD Biodyn. Response to Windblast Jul. 1975 17 p refs (For availability see N75-32716 23-51)
(Contract F33615-74-C-4015)

N75-32726 Research Inst. of National Defence, Stockholm (Sweden).
HIGH SPEED EJECTIONS WITH SAAB SEATS
B. O. Andrae, E. Ek, H. Lorin, and B. Ch. R. Stroemblad *In* AGARD Biodyn. Response to Windblast Jul. 1975 5 p ref (For availability see N75-32716 23-51)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N75-32770 Missouri Univ., Columbia.
DIGITAL CONTROL OF LARGE SCALE HYBRID COMPUTERS Ph.D. Thesis
Wilford C. Pomeroy 1974 246 p
Avail: Univ. Microfilms Order No. 75-20150

The development of inexpensive linear integrated circuits made possible the development of large scale hybrid computers which were previously not feasible. These large scale hybrid computers impose new requirements on the digital system which were not present in previous systems. A general analysis was made of these digital system requirements. A specific hybrid system is described and the digital control hardware for this system is developed. Complete requirements for a high performance, digital-analog data transfer system are specified, and the detailed design of such a system is presented. Major emphasis is placed on the speed and expandibility of this system as well as its adaptability to a wide variety of hybrid system requirements.
Dissert. Abstr.

N75-32771 Pennsylvania State Univ., University Park.
RANDOM ACCESS ACCEPTORS Ph.D. Thesis
John A. Beidler 1974 134 p
Avail: Univ. Microfilms Order No. 75-19729

Various models of random access acceptors (RAA), which are similar to random access machines (RAM), were investigated. Several time results for RAM, including an alternate proof of their diagonalization theorem, are established. It is shown how this theorem can be extended to RAA which have addition and subtraction in their instruction repertoires as well as to 1-RAM, the simplest model of RAM. Time bounds on the simulation of multiplication and division by RAM are also established. It is shown that the sets of languages defined in real time by 1-RAM (1RRTDL) and RAM (RRTDL) form Boolean algebras and that both of these Boolean algebras properly contain the set of languages defined in real time by Turing machines. Three possible space bounds for RAA, memory bound, register bound, and finite register bound, are investigated. It is shown that RAM can simulate RRAA (restricted type of RAA) in polynomial time.
Dissert. Abstr.

N75-32772 Pennsylvania State Univ., University Park.
ALLOCATION ALGORITHMS FOR MINIMIZING EXPECTED ACCESS COSTS ON DRUM-LIKE STORAGE DEVICES Ph.D. Thesis
Roger Alan Cody 1974 147 p
Avail: Univ. Microfilms Order No. 75-19739

Optimizing the performance of a mass storage device, in the sense of minimizing retrieval costs, may be regarded as either a scheduling problem, with record placement given, or as an allocation problem, with the scheduling policy given. Alternately, performance can be measured by the expected cost of retrieving all records, over all possible reference strings, and the analysis is in terms of optimal record placement. This performance measure effectively fixes the scheduling policy, so that a comparison can be made between various allocation schemes. Assuming a stationary probability distribution describing record access frequencies, the problem is formulated in terms of a set of equal length records into a set of blocks to be assigned to the sectors of a drum. The basic combinational problem is shown to be polynomial complete, and a heuristic, which is a modification of the largest-processing-time first scheduling policy, is shown to yield an excellent approximation to the optimal solution.
Dissert. Abstr.

N75-32773 Carnegie-Mellon Univ., Pittsburgh, Pa.
ANALYSIS OF NATURAL SCENES Ph.D. Thesis
Ronald Bert Ohlander 1975 253 p
Avail: Univ. Microfilms Order No. 75-19858

A general segmentation algorithm is proposed which makes effective use of existing techniques to parse natural scenes. The principle operator employed is thresholding. Cutoff values for the thresholding operation were determined from histograms of multiple sensory parameters. Various discontinuities are often present in the histograms; and indicate an area possessing uniformity in some feature (e.g., hue or intensity). The thresholding operation was utilized in a recursive descent control structure to isolate and refine segments of the picture. At each level of recursion the histograms are derived for the largest unprocessed region remaining in the image. Treatment of occlusions, shadows, and highlights, is attacked by performing a case analysis to determine types of these conditions. Dissert. Abstr.

N75-32774# Illinois Univ., Urbana. Coordinated Science Lab.
HIGH DENSITY OPTICAL MEMORY Quarterly Progress Report, Oct. - Dec. 1974
Apr. 1975 4 p
(Contract N00014-67-A-0305-0015)
(AD-A009887) Avail: NTIS CSCL 09/2

During this period, the problem of producing uniformly colored crystals using electron bombardment has been investigated. Computer interface hardware has been completed and preliminary programs have been written for computer testing of the memory. GRA

N75-32775*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A MICROPROCESSOR-BASED SYSTEM FOR LABORATORY DATA ACQUISITION
George H. Wilson, III and Carl T. Herakovich May 1975 147 p refs
(Grant NGR-47-004-129)
(NASA-CR-119139; PB-242055/2; VPI-E-75-11) Avail: NTIS HC $5.75 CSCL 09B

During a test, data are logged by the system and stored on a digital cassette. When the test is complete, the data may be read from the cassette and transmitted over standard telephone lines to an IBM 370 computer for analysis. Complete documentation for the system is provided, including: electrical schematics, a listing of the microprocessor's program, extensive logic flowcharts, and use of the system. Application of the system for processing of load, strain, and acoustic emission data from the simple tension test of a boron-epoxy advanced composite is discussed. The intelligence of the microprocessor is used to provide a reliable, easy to use system which saves time and reduces the errors. GRA

N75-32776# Wisconsin Univ., Madison. Mathematics Research Center.
A SUFFICIENT CONDITION FOR REALIZABILITY OF CONSTRAINED GRAPHS Technical Summary Report
J. M. Yohe Feb. 1975 30 p ref
(Contract DA-31-124-ARO(D)-462)
(AD-A010052; MRC-TSR-1521) Avail: NTIS CSCL 12/1

A constrained graph G is realizable if it is the intersection graph of a collection of arcs in the unit disk (D sup 2), where each arc is required to intersect exactly one (distinct) boundary point of (D sup 2), and the ordering of these boundary points is specified by the constraints on G. In this paper the author obtains a new sufficient condition for a constrained graph to be realizable. This extends work previously done by F. W. Sinden of Bell Labs. GRA

N75-32777# Picatinny Arsenal, Dover, N.J. Management Information Systems Directorate.
PROMS (PROJECTILE MEASUREMENT SYSTEMS PROGRAM)
William H. Bolte Mar. 1975 246 p refs
(AD-A010314; MISD-UM-74-1) Avail: NTIS CSCL 19/1

PROMS is an interactive graphics projectile measurements and engineering design generation program developed for use with the Control Data Corporation 6500/1700/274 Digigraphic System. PROMS effectively enables the user to perform ballistic matching and projectile parametic studies on new munition items. The designer can quickly and easily change, add, delete and move components of the projectile as needed and view the calculated results immediately on the CRT screen. These results include the weight, center of gravity, transverse and polar moments of inertia and displaced volume of the projectile and are displayed along with the assembly drawing of the new design. Projectile data can be viewed and repeatably modified using a light pen and alphanumeric keyboard in a continuous man-machine interactive design loop. GRA

N75-32778# Massachusetts Inst. of Tech., Cambridge.
A PORTABLE COMPILER FOR THE LANGUAGE C
Alan Snyder May 1975 77 p
(Contract N00014-70-A-0362-0006; Grant NSF GJ-34671; ARPA Order 2095; NR Proj. 049-189)
(AD-A010218; MAC-TR-149) Avail: NTIS CSCL 09/2

This paper describes the implementation of a compiler for the programming language C. The compiler has been designed to be capable of producing assembly-language code for most register-oriented machines with only minor recoding. Most of the machine-dependent information used in code generation is contained in a set of tables which are constructed automatically from a machine description provided by the implementer. In the machine description, the implementer models the target machine by defining a machine-dependent abstract machine for which the code generator produces intermediate code. The implementer defines the translation from an abstract machine program to a target machine program by providing in the machine description a set of simple macro definitions for the abstract machine instructions. In addition, macro definitions may be provided in the form of C routines where additional processing capability is needed. GRA

N75-32779# Army Research Inst. for the Behavioral and Social Sciences, Arlington, Va.
AUTOMATED AIDS TO ON-LINE TACTICAL DATA INPUTTING Interim Technical Paper
Michael H. Strub Feb. 1975 31 p refs
(DA Proj. 2Q1-62106-A-721)
(AD-A010350; ARI-Tech-Paper-262) Avail: NTIS CSCL 09/2

In an automated information system the input operator must convert free text information into computer-readable format rapidly and accurately as he enters it into the data base. This report describes and evaluates a computer assisted message inputting (CAMI) aid designed to provide useful additional formatting instructions to operators. Both a full format and an experimental checklist format were used with the CAMI CRT and with a handbook of instructions and sample formats to input scenario-type messages. Subjects were 60 enlisted men divided into five groups, one for each of the experimental conditions plus one using only the handbook and blank-screen CRT. Speed and accuracy were measured. Speed did not differ significantly among the four experimental conditions, but the fifth unaided condition was significantly slower. No significant differences in accuracy appeared. However, over 80% of the total input errors were discovered to be types of error which are not detectable by present automated error-checking routines. This report is part of a continuing program in command information processing

systems, which provides directly usable design information to the Army Tactical Data System (ARTADS). GRA

N75-32780# Environmental Health Lab., McClellan AFB, Calif.
NOISE EVALUATION AND CONTROL TECHNIQUES USED FOR A DATA PROCESSING FACILITY, MARCH AFB, CALIFORNIA Final Report
Harry P. Guy Aug. 1974 50 p refs
(Proj. NBF-344)
(AD-A009999; EHL-74M-12) Avail: NTIS CSCL 09/2

Evaluation of noise generated by manually operated data processing machines was made. Noise levels were measured and a noise profile was constructed. No hazardous levels were measured, but there was interference with verbal communications. Techniques for noise reduction are presented. GRA

N75-32781# Computer Sciences Corp., Silver Spring, Md. System Sciences Div.
FEASIBILITY STUDY OF A QUADRILATERALIZED SPHERICAL CUBE EARTH DATA BASE Final Report, May 1974 - Mar. 1975
F. K. Chan and E. M. ONeill 14 Apr. 1975 137 p refs
(Contract N66314-74-C-1340)
(AD-A010232; CSC/TR-75/6007; EPRF-TR-2-75(CSC)) Avail: NTIS CSCL 09/2

This report describes the results of research into the feasibility of storing satellite meteorological data in a high-resolution, equal-area, computer-accessible data base. Equal area elements are stored in square arrays representing the faces of a cube inscribed within the earth. The required area-preserving transformation is presented along with its inverse. A unique array-mapping scheme is presented, which preserves near-neighbor relations and allows rapid index computation. The implementation of this data base on rotational storage devices is discussed, and calculated execution times are presented. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N75-32782 Mississippi State Univ., State College.
A CLASS OF CONVOLUTIONAL CODES BASED ON BLOCK CODES Ph.D. Thesis
Charles Lyonell Walker 1975 97 p
Avail: Univ. Microfilms Order No. 75-20739

It is possible to characterize any conventional, binary, rate B/N convolutional code as a rate I/N encoder with the inputs shifted in B at a time. An (N, K) block code can be considered as a rate K/N convolutional code without memory. This block code then defines a set of convolutional codes of rate B/N for B = 1,2,...,K. By omitting certain output bits of these codes (e.g., the information bits if the block code is systematic) other classes of convolutional codes can be formed. A number of relationships among these codes, and in particular between the original block code and some convolutional code derived from it in this manner, were found. For a certain class of these codes based on cyclic block codes an exact determination of free distance in terms of the minimum distance of the block code was made. Dissert. Abstr.

N75-32783 Arizona Univ., Tucson.
THE DESIGN OF TRANSPORTABLE INTERPRETERS Ph.D. Thesis
Frederick Charles Druseikis 1975 189 p
Avail: Univ. Microfilms Order No. 75-19594

The Sil/2 language supports the design and implementation of the large runtime support system that is characteristic of interpreter-based implementations of programming languages. Two concepts that appear to be integral to the construction of transportable programs are introduced. The notion of ubiquitous programs, programs that exist on all machines, provides an effective criterion for selecting the tools for constructing transportable programs. A programming methodology called separation structuring can be considered to be a criterion for program modularization that is based on the existence of algorithms for systematically introducing the implementation of a machine-dependent operation. Separation structuring is the vehicle for making ubiquitous programs useful for constructing transportable programs. The Sil/2 language itself has a compiler-based implementation. This compiler-based implementation is transportable, but more importantly the concepts in the design of the Sil/2 language processors suggest an effective generalization of the concept of cross-compilation for the implementation of transportable programs. Dissert. Abstr.

N75-32784 State Univ. of New York, Stony Brook.
MATHEMATICAL MODELS OF MULTIPROGRAMMED COMPUTER SYSTEMS INVOLVING PRIORITY Ph.D. Thesis
Shun Yuh Huang 1974 118 p
Avail: Univ. Microfilms Order No. 74-27790

Two priority queueing models are considered, each assuming (1) the existence of two classes of programs, (2) preemptive priority on the CPU and head-of-the-line priority on the I/O device, and (3) general I/O service time. The behavior of the corresponding systems was studied when such parameters as program size, the number of programs of each class in the system, and I/O service time change. The first model is of a multiprogrammed computer system. The effects on CPU utilization of various scheduling algorithms and memory partitioning strategies are compared when such a system operates under demand paging. The second model allows interactive users, who are assumed to execute only for an infinitesimal time interval. An interactive program originates from a terminal and, after a CPU service, has a specific probability of being returned to the terminal from which it was initiated or being fed back to the CPU queue for more processing. Dissert. Abstr.

N75-32785 Pennsylvania State Univ., University Park.
COMPLETE SETS AND TIME AND SPACE BOUNDED COMPUTATIONS Ph.D. Thesis
Charles Paul Pfleeger 1974 100 p
Avail: Univ. Microfilms Order No. 75-19802

Three problems related to the reduction of incompletely specified finite state machines were examined: completing the transition function, state splitting, and combined row-column reduction. It is shown that the problem of deciding if a given machine may be reduced to an equivalent complete machine of a given size by any of these three techniques is NP-complete. The concepts of reducibility among combinatorial problems and of problems complete for a given complexity bound were extended to the class of deterministic solutions to problems in polynomial bounded time; this technique leads to a class of P-complete problems. It is shown that there are P-complete subproblems of NP-complete problems. These subproblems involve a progressive solution technique for the NP-complete problems. NP-complete problems shown to have P-complete subproblems include satisfiability, clique, exact cover, 0-1 integer programming, and others. Dissert. Abstr.

N75-32786 Florida Univ., Gainesville.
A CELLULAR SYSTEM FOR NON-NUMERIC PROCESSING Ph.D. Thesis
George Prentice Copeland, Jr. 1974 164 p
Avail: Univ. Microfilms Order No. 75-19321

The top-down design of a combined software and hardware system for non-numeric processing was investigated, with emphasis on data base management. The requirements for a generalized data base management system were first reviewed, from which a suitable language was selected for the structural description and manipulation of data. The system requirements, the data language, and cost considerations of present and projected technologies are then used as premises from which a hardware structure and instruction set are derived. The derived hardware structure is a one-dimensional array of identical cells, with the additional features of modular expansion of capacity, a greater degree of independence between response time and data base size, and greater freedom in matching the hardware system to the cost and response time trade offs of different user environments. The software and hardware complexity and cost

are greatly reduced compared to conventional systems.
Dissert. Abstr.

N75-32787 Case Western Reserve Univ., Cleveland, Ohio.
ON ATTRIBUTE GRAMMARS AND THE SEMANTIC SPECIFICATION OF PROGRAMMING LANGUAGES Ph.D. Thesis
Mehdi Jazayeri 1975 107 p
Avail: Univ. Microfilms Order No. 75-19276

The applicability of attribute grammars to automatic compiler generation was studied by reviewing attribute grammars and the circularity problem associated with them. The computational complexity of any general algorithm to test attribute grammars for circularity was found to be exponential. An algorithm is presented which provides a noncircularity condition and can be used in the evaluation of semantic attributes in a compiler. The algorithm can be used along with a parser-generator in the design of a deterministic compiler writing system. Dissert. Abstr.

N75-32788 Waterloo Univ. (Ontario). Solid Mechanics Div.
A LINEAR PROGRAMMING APPROACH TO THE PROBLEM OF MOMENTS
W. W. C. Siu (Hatch Associates, Ltd.), S. S. Sengupta, and N. C. Lind Aug. 1974 15 p refs
(Paper-133) Avail: Issuing Activity

An alternative approach using linear programming to the problem of moments is proposed. Two piecewise approximations to the density function are introduced, leading to two solution spaces; the space of piecewise constant density functions, and the space of distributions with unimodal spline density functions. Author

N75-32789*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSFER-FUNCTION-PARAMETER ESTIMATION FROM FREQUENCY RESPONSE DATA: A FORTRAN PROGRAM
Robert C. Seidel Washington Sep. 1975 33 p refs
(NASA-TM-X-3286; E-8165) Avail: NTIS HC $3.75 CSCL 09B

A FORTRAN computer program designed to fit a linear transfer function model to given frequency response magnitude and phase data is presented. A conjugate gradient search is used that minimizes the integral of the absolute value of the error squared between the model and the data. The search is constrained to insure model stability. A scaling of the model parameters by their own magnitude aids search convergence. Efficient computer algorithms result in a small and fast program suitable for a minicomputer. A sample problem with different model structures and parameter estimates is reported. Author

N75-32790*# Decision Science, Inc., San Diego, Calif.
AN ADAPTIVE MANEUVERING LOGIC COMPUTER PROGRAM FOR THE SIMULATION OF ONE-TO-ONE AIR-TO-AIR COMBAT. VOLUME 2: PROGRAM DESCRIPTION Final Report
George H. Burgin and A. J. Owens Washington NASA Sep. 1975 106 p refs 2 Vol.
(Contract NAS1-9115)
(NASA-CR-2583) Avail: NTIS HC $5.25 CSCL 09B

A detailed description is presented of the computer programs in order to provide an understanding of the mathematical and geometrical relationships as implemented in the programs. The individual sbbroutines and their underlying mathematical relationships are described, and the required input data and the output provided by the program are explained. The relationship of the adaptive maneuvering logic program with the program to drive the differential maneuvering simulator is discussed. Author

N75-32791*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROGRAMS FOR COMPUTING ABSCISSAS AND WEIGHTS FOR CLASSICAL AND NONCLASSICAL GAUSSIAN QUADRATURE FORMULAS
Robert N. Desmarais Washington Oct. 1975 75 p refs
(NASA-TN-D-7924; L-9653) Avail: NTIS HC $4.25 CSCL 09B

Computer programs for computing Gaussian quadrature abscissas and weights are described. For the classical case the programs use Laguerre iteration to compute abscissas as zeros of orthogonal polynomials. The polynomials are evaluated from known recursion coefficients. The nonclassical case is handled similarly except that the recursion coefficients are computed by numerical integration. A sample problem, with input and output, is presented to illustrate the use of the programs. It computes the quadrature abscissas and weights associated with the weight function over the interval (0,1) for quadrature orders from 16 to 96 in increments of 8. Author

N75-32792*# College of William and Mary, Williamsburg, Va. Dept. of Mathematics.
MATRIX BANDWIDTH AND PROFILE REDUCTION
H. L. Crane, Jr. (Comptek Res., Inc., Hyattsville, Md.), Norman E. Gibbs, William G. Poole, Jr., and Paul K. Stockmeyer May 1975 23 p refs
(Grant NGR-47-102-001; Contract N00014-73-A-0374-0001; NR Proj. 044-459)
(NASA-CR-143496; AD-A009431; TR-8) Avail: NTIS HC $3.25 CSCL 09/2

This program, REDUCE, reduces the bandwidth and profile of sparse symmetric matrices, using row and corresponding column permutations. It is a realization of the algorithm described by the authors elsewhere. It was extensively tested and compared with several other programs and was found to be considerably faster than the others, superior for bandwidth reduction and as satisfactory as any other for profile reduction. GRA

N75-32793# Massachusetts Inst. of Tech., Cambridge.
ENCRYPTION SCHEMES FOR COMPUTER CONFIDENTIALITY
Vera Pless May 1975 23 p refs
(Contract N00014-70-A-0362-0006; ARPA Order 2095)
(AD-A010217; MAC-TM-6315) Avail: NTIS CSCL 09/2

With the ever-increasing amount of data stored on computers, the need for security in transmission becomes greater and greater. The author considers some new stream enciphering schemes based on J-K flip-flops. The data is considered to be a stream of binary bits. There are two main types of encipherment schemes; a block scheme and a stream scheme. Since the aim of this paper is to present some new stream enciphering schemes, the author describes briefly a general stream enciphering scheme. GRA

N75-32794# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
ERROR ANALYSIS FOR DIGITAL FILTERS WITH LADDER STRUCTURES
Walter H. Ku and Siu-Ming Ng Feb. 1975 109 p refs
(Contract F30602-72-C-0497; AF Proj. 9567)
(AD-A007030; RADC-TR-75-25) Avail: NTIS CSCL 09/5

This report presents an approach to the error analysis and simulation of digital filters. The technique is applied specifically to a study of various wave digital filter structures. The pseudo-state formulation is introduced and forms the basis of a general purpose analysis and simulation program for digital filters. It is found that such a formulation is especially suitable for implementation using the APL language. Wave digital filter design techniques are briefly reviewed and illustrated with several examples. Comparison study of wave digital filters and the cascade form regarding coefficient sensitivity and round-off noise has been performed. It is found that properly designed wave digital filters are superior in both aspects. Finally, two simple second-order wave digital filters are designed and their eigenvalue sensitivities analyzed. GRA

N75-32795# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PLOTTING ADDITIONS TO THE BRL HEMP CODE Final Memorandum Report
Toni M. Taylor May 1975 88 p refs
(AD-A010321; BRL-MR-2479) Avail: NTIS CSCL 19/1

The BRL HEMP code, a time-dependent, two-dimensional, finite-difference FORTRAN computer code, originally developed at the Lawrence Livermore Laboratory, has been modified to produce, as standard output, plots of magnitude of velocity versus time for any grid point and magnitude of velocity and direction of velocity versus position for any grid line. A detailed description

of all the necessary FORTRAN coding for this plotting addition and where in the BRL HEMP code it belongs is presented along with a complete listing. GRA

N75-32796# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE COMPLEXITY OF FINITE, PUSHDOWN, AND STACK AUTOMATA Summary Report
H. B. Hunt, III Mar. 1975 58 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GJ-35570)
(AD-A010088; MRC-TSR-1504) Avail: NTIS CSCL 09/2

The complexity of predicates on the 1-way finite, pushdown, and stack automata languages is studied. Every nontrivial predicate on the 1-way stack languages is shown to require exponential time, when applied to the stack automata, indexed grammars, or OI-macro grammars. Every nontrivial predicate on the context-free languages requires as much time and space as any 2-way pushdown automaton language. GRA

N75-32797# University of Southern Calif., Marina del Rey. Information Sciences Inst.
PRIM USER'S MANUAL
Louis Gallenson, Joel Goldberg, Ray Mason, Donald Oestreicher, and Leroy Richardson Apr. 1975 131 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A009936; ISI/TM-75-1) Avail: NTIS CSCL 09/2

This document is a four-part technical manual to aid the users of the Programming Research Instrument (PRIM), a major time-shared microprogramming facility which permits individual researchers to create specialized computing systems adapted to their needs. The document consists of an overview, a user's guide, and reference manuals for the General Purpose Microprogramming language (GPM) and the MLP-900 microprocessor. GRA

N75-32798# Naval Ship Research and Development Center, Bethesda, Md.
AUDIT, A SYSTEM FOR SOFTWARE ENGINEERING FOR THE CDC 6000
L. M. Culpepper and R. Regen Nov. 1974 237 p refs
(AD-A010136; NSRDC-4587) Avail: NTIS CSCL 09/2

A software system (AUDIT) has been developed to examine contractor-produced computer programs for compliance with prescribed standards of programming form and style and to facilitate study of the output behavior of a program as a function of computer word length. AUDIT is coded in FORTRAN 4 and is operational on the CDC 6000, UNIVAC 1108, and IBM 360 computers. GRA

N75-32799# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
A PARTIAL STRUCTURE FOR PERFORMANCE EVALUATION
Stephen R. Kimbleton (USC/Inform. Sci. Inst.) May 1973 10 p refs Presented at the AEC Sci. Computer Inform. Exchange, San Francisco, May 1973.
(Contract N00014-67-A-0181-0036; NR Proj. 049-311)
(AD-A010214) Avail: NTIS CSCL 09/2

Discussions of performance evaluation are often severely impeded by the lack of a common framework or viewpoint. In this paper a partial taxonomy for the field of performance evaluation is provided along with an indication of some of the primary concerns in each of the four major categories of this taxonomy. In particular, it is shown that in discussing the performance of an installation one must first establish the reason for the evaluation effort, the level at which the evaluation is to be conducted, the technique to be used in the evaluation process and the evaluation tools which are available. GRA

N75-32800# Kansas State Univ., Manhattan. Dept. of Computer Science.
STEPS TOWARD RELIABLE SOFTWARE: PROCEEDINGS OF A WORKSHOP
P. Fisher, ed., M. Hankley, ed., and J. McCall, ed. Jan. 1975 88 p refs Workshop held at Falls Church, Va., 19-20 Nov. 1974
(Contract DAHC04-75-G-0075)
(AD-A010396) Avail: NTIS CSCL 09/2

This report describes the proceedings of a two-day Reliable Software Workshop which was sponsored by USACSC in November 1974 with the objective of identifying potentially beneficial research approaches for improvement of software reliability in the military's software production environment. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N75-32801# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EXPERIMENTAL MULTI-MACHINE COMPUTER COMPLEX
V. M. Radunskii 12 Feb. 1975 28 p refs Transl. into ENGLISH from Vychisl. Sist. (USSR), no. 51, 1972 p 97-107
(FTD Proj. T74-05-12)
(AD-A007185; FTD-MT-24-0250-75) Avail: NTIS CSCL 09/2

An experimental multiprocessor/system designed to simulate parallel-flow processes is described. Topics discussed include: construction of assessible core storage, communicating system and elementary computer, and possible organization of various multiprocessor systems. J.M.S.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N75-32802 State Univ. of New York, Buffalo.
THE OPTIMIZATION AND STATE ESTIMATION OF DISTRIBUTED PARAMETER SYSTEMS Ph.D. Thesis
Milind Ajinkya 1975 185 p
Avail: Univ. Microfilms Order No. 75-18767

Two major areas of the modern control theory and their applications were studied: state estimation and optimization. A discrete time, nonlinear, sequential filter was developed for coupled lumped and distributed parameter systems, and was applied to a real metallurgical problem of ingot-heating in the steel industry. Another application studied of a general distributed parameter filter is the real time estimation of the coke content of a deactivating catalyst for the isomerization of n-pentane. A third application studied is the experimental implementation of a linear, distributed parameter filter for the temperature control of a metal slab. An optimal temperature policy was developed for an experimental reactor for the isomerization of n-pentane, where the platinum-reforming catalyst suffers from deactivation. Also reported are some optimization studies for the dehydrogenation of butene to butadiene. Dissert. Abstr.

N75-32803# Massachusetts Univ., Amherst. Dept. of Computer and Information Science.
THE DESIGN OF A SEMANTICALLY DIRECTED VISION PROCESSOR REVISED AND UPDATED
Allen R. Hanson and Edward M. Riseman Feb. 1975 58 p refs
(Contract N00014-67-A-0230-0007)
(AD-A010150; COINS-TR-75C-1) Avail: NTIS CSCL 09/2

This paper updates the design of a semantically directed vision processor. The system will carry out model-directed analysis of outdoor scenes by applying semantic knowledge at an early stage of processing. The goal is to quickly and flexibly interface low-level visual features (e.g., edge detectors, texture and color analyses) and high-level conceptual knowledge (e.g., trees stem from the ground, general knowledge associated with road scenes, and the like) in the perception of complex images. The computational structure for rapidly extracting visual features is called a processing cone. The cone consists of parallel spatial arrays of micro-computing elements, each of which operate on a local window to reduce the data layer by layer. Information flows up, down, and laterally in the cone via a sequence of

local parallel operations. Routines for detecting objects will examine the data at the top of the cone and will selectively analyze the lower level mass of data. Rough confidences of the presence of objects in various regions will be passed to the model builder. GRA

N75-32804# Massachusetts Univ., Amherst. Dept. of Computer and Information Science.
SOME CONSIDERATIONS IN A MODEL BUILDING SYSTEM FOR SCENE ANALYSIS
Daniel H. Fishman, Allen R. Hanson, and Edward M. Riseman Mar. 1975 36 p refs
(Contracts N00014-75-C-0459; N00014-67-A-0230-0007)
(AD-A010149; COINS-TR-75C-2) Avail: NTIS CSCL 09/2

This paper outlines the design of a system, called VISIONS, whose goal is to build a semantic 3-dimensional model from a 2-dimensional digitized scene. There are many kinds of information that must be employed in model construction, ranging from processed visual data to highly structured semantic information embodied in context frames. The modular subsystems that process this information interact through an executive which is responsible for the model construction. The authors discuss a variety of considerations in making such a system both flexible and feasible. Brief arguments are offered for dealing with confidences, expectations, and importance of objects, attributes, and partial models in a rough manner. A simplified scenario of model construction demonstrates how the system might work. GRA

N75-32805# Massachusetts Univ., Amherst. Dept. of Computer and Information Science.
REGION GROWING IN TEXTURED OUTDOOR SCENES
Allen R. Hanson, E. M. Riseman, and P. Nagin Feb. 1975 16 p refs Presented at the Milwaukee Symp. on Autom. Computations and Control, Milwaukee, 18-19 Apr. 1975
(Contract N00014-67-A-0230-0007)
(AD-A010148; COINS-TR-75C-3) Avail: NTIS CSCL 09/2

Some progress has been made in scene analysis in finding boundaries between textured objects. However, standard line-finding and region growing algorithms have not been able to deal with strong local variations of intensity and color that repeat themselves more globally in images of natural scenes. These problems are significant with respect to both micro-texture, say the leaves of a tree, as well as macro-texture, the light green of leafy branches vs. dark green or black shadows between branches in a tree. How can local variations be globally bound together into a cohesive region for perceptual identification. The approach that is being examined involves the reduction in size of the image while extracting features such as intensity, color, and color variation in local windows across the image. GRA

N75-32806# Sperry Univac, St. Paul, Minn. Defense Systems Div.
PROSODIC AIDS TO SPEECH RECOGNITION. 6: TIMING CUES TO LINGUISTIC STRUCTURE AND IMPROVED COMPUTER PROGRAMS FOR PROSODIC ANALYSIS Semiannual Technical Report, 1 Sep. 1974 - 28 Feb. 1975
Wayne A. Lea and Dean R. Kloker 31 Mar. 1975 71 p refs
(Contract DAHC15-73-C-0310; ARPA Order 2010)
(AD-A010221; PX-11239) Avail: NTIS CSCL 05/7

Computer programs for detecting syntactic boundaries (BOUND 3) and locating stressed syllables (STRESS) have been supplied to ARPA contractors. Descriptions of the operation and performance of these programs are provided, and suggestions for further improvements in these programs are given. Experiments were conducted on various timing cues that correlate with phonological and syntactic phrase boundaries. Further experiments are planned, dealing with carefully controlled studies of how prosodic information gives cues to the type of sentence spoken, the appropriate syntactic bracketing to assign, and the occurrence of subordination. Further studies of the BOUND 3 and STRESS programs will be conducted, and improved versions of those prosodic analysis programs will be used to aid parsing and word matching in ARPA speech understanding systems. GRA

N75-32807# Naval Postgraduate School, Monterey, Calif.
FEATURE SELECTION FOR THE IDENTIFICATION OF BAUDED SIGNALS
Thomas Arthur Reglein Mar. 1975 156 p refs
(AD-A009974) Avail: NTIS CSCL 09/2

This paper investigates some of the difficulties commonly encountered in the application of pattern recognition techniques to the identification of noncooperative signals. Practical problems of feature selection and analysis are explored for a data base of actual bauded signal transition times. Analysis of a set of features based on the raster display of these transition times suggests that the use of fast Fourier transform techniques may yield useful identifying parameters not exploitable by the current process of visual comparison of signal raster patterns. GRA

N75-32808# Digital Programming Services, Inc., Waltham, Mass.
DETERMINING THE VOLUME REPRESENTED BY AN IRREGULARLY SHAPED CROSS-SECTIONAL AREA Interim Report
Lawrence E. Belsky 1 Apr. 1975 36 p refs
(Contract F19628-75-C-0043; AF Proj. 627A)
(AD-A010059; SR-1; AFCRL-TR-75-0165) Avail: NTIS CSCL 09/2

The problem of determining apparent volume from a two dimensional shape occurs when a volume is desired to differentiate shapes for pattern recognition. This differentiability for pattern recognition becomes especially important when examining a plane projection of a three dimensional object. In addition, the same problem occurs in the determination of liquid content when the object has been sensed by a two dimensional detector, as the Knollenberg sensing device. The sensors give a picture of the shapes which have been projected onto the two dimensional plane parallel to the sensor orientation. Calculation of the liquid water content relies on some approximation to the volume of shapes so seen. This paper details a method which can be used to obtain volumes of revolution, when the two-dimensional shape, however irregular, is known by a matrix of binary sensors. GRA

N75-32809# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SYNTAX, SEMANTICS AND SPEECH
William A. Woods Apr. 1975 67 p refs
(Contract N00014-75-C-0533; ARPA Order 2904)
(AD-A009939; BBN-3067; AI-5) Avail: NTIS CSCL 05/7

The paper attempts to provide an introduction to the techniques and results which have come out of work in computational linguistics which have special relevance to the design of speech understanding systems. The author attempts to trace the development of several important ideas and trends in parsing and syntax and in semantic interpretation. GRA

N75-32810# Arizona Univ., Tucson. Dept. of Mathematics.
SINGULAR PERTURBATIONS AND ORDER REDUCTION IN CONTROL THEORY: AN OVERVIEW
R. E. OMalley, Jr., P. V. Kokotovic (Illinois Univ., Urbana), and P. Sannuti (Rutgers Univ., New Brunswick, N.J.) 5 May 1975 34 p refs
(Contracts N00014-67-A-0209-0022; DAAB07-72-C-0259; Grants NSF eng-74-20091; AF-AFOSR-2570-73; NR Proj. 041-466)
(AD-A010203; TR-10) Avail: NTIS CSCL 12/1

Recent results on singular perturbations are surveyed as a tool for model order reduction and separation of time scales in control system design. Conceptual and computational simplifications of design procedures are examined by a discussion of their basic assumptions. Over one hundred references are organized into several problem areas. The content of main theorems is presented in a tutorial form aimed at a broad audience of engineers and applied mathematicians interested in control, estimation and optimization of dynamic systems. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N75-32811 Carnegie-Mellon Univ., Pittsburgh, Pa.
DISCRETE WEIGHTED RESIDUAL METHODS Ph.D. Thesis

Dave Irwin Schonbach 1974 320 p
Avail: Univ. Microfilms Order No. 75-17847

Discrete weighted residual methods (DWRM), which constitute a broad class of engineering tools comprising many individual methods, all of which are designed to generate efficient and rapid approximate solutions of both linear and nonlinear discrete boundary-value problems, were developed and illustrated. The technical aspect of DWRM is developed for boundary-value problems in scalar ordinary difference equations. The convergence properties of DWRM are discussed. The application of DWRM to the solution of boundary-value problems in partial difference equations is indicated. Illustrations are given by solving exemplary problems. These include a random walk problem, discretized versions of continuous boundary-value problems, physical problems, an eigenvalue problem, and a sensitive nonlinear problem. The computational advantages of the discrete (Legendre) orthogonal polynomials as the assumed modes in conjunction with DWRM are illustrated. The properties of these polynomials are unified and tabulated. Dissert. Abstr.

N75-32812 Princeton Univ., N.J.
THE BIVARIATE STRUCTURE AND REPRESENTATION OF RANDOM PROCESSES Ph.D. Thesis
Gary Lamar Wise 1974 172 p
Avail: Univ. Microfilms Order No. 75-20675

Bivariate density functions are represented by diagonal series expansions in terms of orthonormal functions, and some aspects of such expansions of bivariate densities were studied. Various properties of the bivariate density functions associated with certain classes of random processes are investigated.
Dissert. Abstr.

N75-32813 East Texas State Univ., Commerce.
A STUDY OF FRACTIONAL CALCULUS: ITS DEFINITIONS AND PROPERTIES Ph.D. Thesis
Annelle Funderburg Fowler 1975 82 p
Avail: Univ. Microfilms Order No. 75-19970

A study was conducted, through a search of the literature, to identify, assemble, and synthesize the materials relative to fractional calculus. To derive a basic understanding of fractional calculus, articles of a fundamental nature such as definitions and elementary theorems were carefully examined. Five comprehensive definitions were chosen as representative of the literature, and from these five the Riemann-Liouville definition was selected as the fundamental definition for the study. Based upon the Riemann-Liouville definition for fractional calculus, properties inherent to that topic were proved. Findings and conclusions are presented and discussed. Dissert. Abstr.

N75-32814 Oregon Univ., Eugene.
FORMS THAT HAVE A LINEAR FACTOR AND SIMPLE JORDAN CUBIC FORMS Ph.D. Thesis
Gary Owen Fowler 1975 69 p
Avail: Univ. Microfilms Order No. 75-18728

The existence of a linear factor in a direct sum and in a tensor product is examined. The question of equivalence of two forms that have a linear factor is also considered. All but one equivalence class of forms with a linear factor were additively indecomposable. With one exception, every equivalence class of cubic forms that have a linear factor was multiplicatively indecomposable (i.e., irreducible under tensor product). Unique factorization under tensor product is considered. Under very severe restrictions a unique factorization theorem was proved, using a classification of cubic forms that have a linear factor. Two classes of Jordan algebras were examined. The algebras in both of these classes are separable. Their generic traces are Frobenius functionals, and they correspond to cubic forms. Dissert. Abstr.

N75-32815 Utah Univ., Salt Lake City.
BOUNDARY VALUE PROBLEMS FOR SECOND ORDER ORDINARY DIFFERENTIAL EQUATIONS AND APPLICATIONS TO SINGULAR PERTURBATION PROBLEMS ON [a,b] IS A SUBSET OF (MINUS INFINITY, INFINITY) Ph.D. Thesis
Tai-Chi Lee 1975 71 p
Avail: Univ. Microfilms Order No. 75-19697

Appropriate conditions are given which imply the existence of solutions to two-point boundary value problems for second order nonlinear functional equations. Solutions were obtained by application of the Tonelli procedure for demonstrating the existence of solutions to initial value problems and the intermediate value theorem for continuous functions. Solutions to the boundary value problem are found between the upper and lower solutions of the equation. These results generalize most of the existence theorems for the solutions of two-point boundary value problems on the finite interval and also apply to nonlinear boundary conditions. Dissert. Abstr.

N75-32816 Houston Univ., Tex.
NONLINEAR INTEGRAL EQUATIONS AND PRODUCT INTEGRALS Ph.D. Thesis
Alvin John Kay 1975 55 p
Avail: Univ. Microfilms Order No. 75-20746

An analysis was made of product integrals and their use to solve a nonlinear integral equation. Theorems are proved and definitions given for functions in the ordered sets. Conditions are given under which the above functions are valid.
Dissert. Abstr.

N75-32817 New Hampshire Univ., Durham.
NORMED NEAR ALGEBRAS AND FINITE DIMENSIONAL NEAR ALGEBRAS OF CONTINUOUS FUNCTIONS Ph.D. Thesis
Joel W. Irish 1975 155 p
Avail: Univ. Microfilms Order No. 75-19875

A real near algebra system is described as a real algebra which lacks the left distributive property and the scalar property $x(ty)=t(xy)$. Analysis and function near algebras were investigated. A real normed near algebra is a near algebra over the field Ir such that the linear space is a normed space. This condition is not strong enough to force continuity of multiplication in both variables. The right multiplication operator is a continuous function. Every normed near algebra without identity can be isomorphically embedded in a normed near algebra with identity provided $x(ty)=t(xy)$ for all t greater than or equal to 0. Every finite dimensional positive homogeneous normed near algebra with orthogonal idempotent basis is a D-normed near algebra and multiplication is continuous. The major result deals with the finite dimensional sub near algebras. Dissert. Abstr.

N75-32818 Florida Univ., Gainesville.
ANALYSIS OF CONTINUOUS PROPORTIONS Ph.D. Thesis
David Walter Johnson 1974 150 p
Avail: Univ. Microfilms Order No. 75-19348

Two possible distributions, the Dirichlet distribution and a generalization of the Dirichlet distribution, are proposed as models for the response vector. The general inference problems of estimation and hypothesis testing for these distributions were investigated. A univariate response consists of a single continuous proportion, and it is assumed that such a response will follow a beta distribution. The problem is to estimate and to conduct tests of hypothesis about the parameters and mean of such a beta distribution. Methods are discussed of estimation for the beta distribution. Two sets of estimators, the moment estimators and the maximum likelihood estimators, are given for the parameters of the beta distribution. Various tests of hypothesis are constructed for the parameters and mean of the beta distribution. Methods for obtaining both the moment and the maximum likelihood estimators for the parameters of the Dirichlet distribution are given. Dissert. Abstr.

N75-32819 Harvard Univ., Cambridge, Mass.
TWO-POINT TENSOR ANALYSIS OF THE KINEMATICS AND CONSERVATION LAWS OF RELATIVITY Ph.D. Thesis
John Douglass Lathrop 1974 134 p
Avail: Univ. Microfilms Order No. 75-18081

Two-point tensor analysis was used to render discussions in relatively coordinate independent. Topics discussed include: (1) a covariant treatment of kinematics in relativity, illustrated by an analysis of local motion in the Godel universe, in which the inertial acceleration is covariantly decomposed into its impressed, D'Alembert, Coriolis, centrifugal, Euler, and tidal gravitational components; (2) a formualtion of the spectra shift of light which covariantly divides the shift into its gravitational and Doppler

components; and (3) a derivation of the covariant formulae for the conserved total four-momentum and angular momentum of an isolated physical system. Dissert. Abstr.

N75-32820 American Univ., Washington, D.C.
AN OPERATOR METHOD FOR LOWER BOUNDS TO EIGENVALUES Ph.D. Thesis
James Thomas Stadter 1975 51 p
Avail: Univ. Microfilms Order No. 75-20022

A procedure for calculating lower bounds to eigenvalues of semi-bounded self-adjoint operators is presented. This method was obtained in terms of linear operators in Hilbert space. This operator formulation gives results on the structure of the procedure and permits its principal properties to be obtained by operator comparison techniques. The method consists of two steps: first is the construction of a base operator with eigenvalues below those of the given operator; in the second step the lower bounds provided by the eigenvalues of the base operator are improved through the construction of a comparison operator which is larger than the base operator but smaller than the given operator. The base operator and the comparison operator are constructed in terms of two nonorthogonal projection operators. The two projection operators are derived explicitly and they are shown to be related in a special manner. Dissert. Abstr.

N75-32821 Michigan Univ., Ann Arbor.
A PROJECTION METHOD FOR THE NUMERICAL SOLUTION OF A SYSTEM OF FIRST-ORDER NONLINEAR DIFFERENTIAL EQUATIONS WITH MIXED BOUNDARY CONDITIONS Ph.D. Thesis
Hendrik Michiel VanSchieveen 1975 235 p
Avail: Univ. Microfilms Order No. 75-20469

Because of the finite-dimensionality of any computing process, all algorithms for the numerical solution of two-point boundary value problems (TPBVP's) involve some kind of discretization. Quite a few discretization procedures can be formulated with the aid of projectors onto finite-dimensional subspaces of the solution space. These projection type methods were shown, in combination with polynomial and piecewise polynomial functions, to be effective techniques for the solution of linear and mildly nonlinear Nth order scalar differential equations with linear boundary conditions. A projection method is discussed for a system of first-order nonlinear differential equations with mixed boundary conditions. Topics discussed include: (1) the practicality, the convergence and the speed of convergence; (2) the estimation of the difference between the approximate and the exact solutions of that particular TPBVP; and (3) the development of easy to program algorithms to actually compute approximate solutions. An example of the projection method involving spline spaces in X is included. Dissert. Abstr.

N75-32822 Pittsburgh Univ., Pa.
SOLUTIONS OF LAPLACE AND SCHROEDINGER EQUATIONS Ph.D. Thesis
Candadi V. Sukumar 1974 96 p
Avail: Univ. Microfilms Order No. 75-18259

In conjunction with experimental investigations of the characteristics of quadrupole mass spectrometers, a Green's function technique was developed to permit accurate computation of the fields inside the spectrometer. In potential scattering theory the partial wave sum can be replaced, through the Watson-Sommerfeld transform, by a summation over contributions from Regge poles, together with a background integral. In electron-atom scattering at energies of the order of 100 eV the observed differential scattering cross-sections suggest that the scattering amplitude might be dominated by the contribution from one or two poles. Two techniques were developed through which the positions of the Regge poles and the associated residues of the S-matrix can be determined. A variational principle is derived which is useful for electron-atom collisions, and direct integration methods using complex coordinates are used for ion-atom systems. Calculations were performed on potentials representing e-Ar and H(+)-Ar interactions. Dissert. Abstr.

N75-32823 Waterloo Univ. (Ontario). Solid Mechanics Div.
OPTIMAL SOLUTIONS IN PROBABILISTIC STRUCTURAL DESIGN. PART 1: THEORY. PART 2: APPLICATIONS
S. R. Parimi and M. Z. Cohn Jun. 1974 35 p refs Submitted for publication
(Paper-131) Avail: Issuing Activity

A complete probabilistic design methodology is presented which is based on two behavioral criteria; the conditions of collapse, and loss of serviceability as applied to inelastic framed structures. The theoretical results of analysis and design are illustrated on a reinforced concrete frame example. These results and the accompanying sensitivity studies attempt to clarify the nature of the probabilistics structural design problem. Author

N75-32824 Waterloo Univ. (Ontario). Solid Mechanics Div.
A FORMULATION OF PROBABILISTIC DESIGN
N. C. Lind Apr. 1974 24 p refs Sponsored by the National Res. Council of Canada
(Paper-128) Avail: Issuing Activity

A transformation of the random variables in a problem of probabilistic design into standardized independent Gaussian variables is proposed as a means of assigning a reliability index to a design. Probability bounds can be obtained rigorously as functions of the reliability index. The approach extends the useful reliability index concept from second moment formats to probabilistic formats. Author

N75-32825 Waterloo Univ. (Ontario). Solid Mechanics Div.
ON A MODIFIED RAYLEIGH'S QUOTIENT FOR A CERTAIN NONCONSERVATIVE EIGENVALUE PROBLEM
H. H. E. Leipholz Jan. 1974 25 p refs Submitted for publication
(Paper-125) Avail: Issuing Activity

Using the minimum principle related with the Rayleigh quotient, the eigenvalues of Pfluger's rod can be determined approximately by means of admissible functions. The first buckling load of Pfluger's rod can be enclosed in lower and upper bounds, and a generalized conservation theorem and a corresponding Liapunov functional can be found for Pfluger's rod. Author

N75-32826 Waterloo Univ. (Ontario). Solid Mechanics Div.
ON THE METHOD OF TREFFTZ IN THE LIGHT OF A GENERALIZED VARIATIONAL PRINCIPLE
H. H. E. Leipholz Jun. 1973 36 p refs Submitted for publication
(Paper-121) Avail: Issuing Activity

Using the most general variational principle existing for conservative and nonconservative systems, the close connection between the two methods of Galerkin and of Trefftz is shown. Depending on the kind of coordinate functions, either Galerkin's equations or Trefftz' equations were obtained from the same principle. Author

N75-32827 Suomalainen Tiedeakatemia, Helsinki (Finland).
DUAL C(ASTERISK)-ALGEBRAS, WEAKLY SEMI-COMPLETELY CONTINUOUS ELEMENTS, AND THE EXTREME RAYS OF THE POSITIVE CONE
Kari Ylinen 1975 11 p refs
(ISBN-951-41-0216-9) Copyright. Avail: Issuing Activity

A theorem stating that a C*-algebra A is dual if and only if every element of A is weakly semi-completely continuous is extended. Corrolaries, monomial actions, and extreme rays of the positive cone are also discussed. M.J.S.

N75-32828 Suomalainen Tiedeakatemia, Helsinki (Finland).
LINEAR EXTREMAL PROBLEMS FOR ANALYTIC FUNCTIONS WITH INTERIOR SIDE CONDITIONS
Dennis A. Hejhal 1974 39 p refs
(ISBN-951-41-0200-2) Copyright. Avail: Issuing Activity

The method of dual extremal problems is applied to problems involving analytic functions which satisfy interior side-conditions. The method consists of three essential parts: (1) the study of the minimum problem by variational methods; (2) reduction to simpler extremal problems; and (3) approximation. The method described is applicable to general linear extremal problems and is entirely classical in nature. J.M.S.

N75-32829*# Kanner (Leo) Associates, Redwood City, Calif.
THIRD ORDER, LINEAR, HOMOGENEOUS DIFFERENTIAL EQUATION
Michal Gregus Washington NASA Sep. 1975 59 p refs Transl. into ENGLISH from Wiss. Z. Martin-Luther Univ.,

Halle-Wittenberg, Math.-Naturwiss. Reihe (East Germany), v. 7, no. 3, Mar. 1963 p 265-286
(Contract NASw-2790)
(NASA-TT-F-14204) Avail: NTIS HC $4.25

The fundamental properties of the solutions of third order, linear, homogeneous differential equations are discussed. The concept of a so-called pencil of solutions is introduced and its properties are studied. The oscillatory properties of the solutions, third-order boundary-value problems and the asymptotic properties of the solutions are investigated. Finally, a remark concerning the mutual transformation of the solutions of two such third order differential equations is introduced. Author

N75-32830# Arizona Univ., Tucson. Dept. of Mathematics.
THE NUMERICAL SOLUTION OF BOUNDARY VALUE PROBLEMS FOR STIFF DIFFERENTIAL EQUATIONS
Joseph E. Flaherty and Robert E. OMalley, Jr. 25 Apr. 1975 54 p refs Prepared in cooperation with Rensselaer Polytechnic Inst., Troy, N. Y.
(Contract N00014-67-A-0209-0022; Grant NSF GR-27; NR Proj. 041-466)
(AD-A009861; TR-9) Avail: NTIS CSCL 12/1

The numerical solution of boundary value problems for certain stiff ordinary differential equations is studied. The methods developed use singular perturbation theory to construct approximate numerical solutions which are valid asymptotically; hence, they have the desirable feature of becoming more accurate as the equations become stiffer. Several numerical examples are presented which demonstrate the effectiveness of these methods. GRA

N75-32831# New Mexico Univ., Albuquerque. Dept. of Mathematics and Statistics.
APPLICATION OF A DOMINATED CONVERGENCE THEOREM TO THE EMPIRICAL BAYES PROBLEM
J. J. Deely and W. J. Zimmer Oct. 1974 11 p refs Prepared in cooperation with Canterbury Univ., Christchurch, New Zealand
(Contract N00014-68-A-0155-0003)
(AD-A001136; TR-303) Avail: NTIS CSCL 12/1

The purpose of this paper is to obtain weaker sufficient conditions than those given by Robbins for the asymptotic optimality of empirical Bayes procedures. In so doing a general method for proving asymptotic optimality is given which because of its simplicity should prove quite useful not only for the empirical Bayes problem but for other related asymptotic problems as well. Three areas of application are indicated. GRA

N75-32832# Wisconsin Univ., Madison. Mathematics Research Center.
THE BACKWARD BEAM EQUATION AND THE NUMERICAL COMPUTATION OF DISSIPATIVE EQUATIONS BACKWARDS IN TIME
Alfred Carasso Mar. 1975 49 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010053; MRC-TSR-1534) Avail: NTIS CSCL 12/1

A survey is given of the backward beam equation approach in the numerical computation of backwards parabolic equations. The discussion includes problems with variable coefficients as well as an example of nonlinear equations: Burgers' equation. Numerical experiments are presented. GRA

N75-32833# Wisconsin Univ., Madison. Mathematics Research Center.
HYPERBOLIC SETS AND SHIFT AUTOMORPHISMS
C. Conley Feb. 1975 18 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010054; MRC-TSR-1502) Avail: NTIS CSCL 12/1

An elementary discussion of hyperbolic invariant sets is presented and a proof of the theorem that near any non-periodic chain recurrent point there lies an embedded shift automorphism is indicated. GRA

N75-32834# Wisconsin Univ., Madison. Mathematics Research Center.
NINE-POINT DIFFERENCE SOLUTIONS FOR POISSON'S EQUATION Technical Summary Report
J. Barkley Rosser Mar. 1975 26 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010056; MRC-TSR-1523) Avail: NTIS CSCL 12/1

It is shown that stencils exist for the sixth order solution of Poisson's equation by use of a nine-point difference approximation. GRA

N75-32835# Wisconsin Univ., Madison. Mathematics Research Center.
A NOTE ON THE HISTORY OF SERIES Technical Summary Report
Richard Askey Mar. 1975 21 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GP-33897)
(AD-A010055; MRC-TSR-1532) Avail: NTIS CSCL 12/1

Some of the important evaluations of sums and transformations of series are much older than the commonly given dates. Some examples are given. GRA

N75-32836# Naval Surface Weapons Center, White Oak, Md.
EXTENDED TABLES OF FORMULAE FOR FINITE SERIES
L. F. Libelo and F. S. Libelo Feb. 1975 29 p refs
(AD-A006514; NSWC/WOL/TR-75-11) Avail: NTIS CSCL 12/1

Mathematical formulae are explicitly presented for a finite series of several different forms. These extended tables have application in much more general areas than that for which they were originally derived. They represent an extension of earlier work directed at evaluating the range of validity of the quantum-statistical-mechanical theory known as the self consistent cluster variation method, and particularly its role in formulating the theory of phase transitions. GRA

N75-32837# Wisconsin Univ., Madison. Mathematics Research Center.
SHORTEST STRING CONTAINING ALL PERMUTATIONS
P. J. Koutas, , and T. C. Hu Feb. 1975 17 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GJ-28339A1)
(AD-A010085; MRC-TSR-1402) Avail: NTIS CSCL 12/1

In this paper, the authors consider the problem of constructing a shortest string of the set (1,2, ..., n) containing all permutations on n elements as subsequences. For example, the string 1 2 1 3 1 2 1 contains the 6(+3!) permutations of the set (1,2,3) and no string with less than 7 digits contains all the six permutations. Note that a given permutation, such as 1 2 3, does not have to be consecutive but must be from left to right in the string. We shall first give a rule for constructing a string of (1,2,...,n) of infinite length and then show the leftmost n2 - 2n + 4 digits of the string contain all n permutations (for n>3). We conjecture that the number of digits f(n) + n2 -2n + 4 (for n>3) is the minumum. Then we study a new function F(n,k) which is the minimum number of digits required for a string of n digits to contain all permutations of i digits, i<k. We conjecture that F(n,k) = k(n-1) for 4< k <n-1. GRA

N75-32838# Wisconsin Univ., Madison. Mathematics Research Center.
THE DISTRIBUTION OF SOJOURN TIMES IN FINITE ABSORBING MARKOV CHAINS
Thomas Nagylaki Feb. 1975 10 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010087; MRC-TSR-1513) Avail: NTIS CSCL 12/1

The distribution of the time spent before absorption in various states of finite Markov chains with time-independent transition probabilities is derived. All the moments of this distribution are calculated. The problem is of interest in population genetics. GRA

N75-32839# Wisconsin Univ., Madison. Mathematics Research Center.
ON TRAVELING WAVE SOLUTIONS OF NON-LINEAR DIFFUSION EQUATIONS
C. Conley Feb. 1975 20 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010057; MRC-TSR-1492) Avail: NTIS CSCL 12/1

An existence proof for periodic traveling wave solutions of an equation of Nagumo is outlined. The proof begins with the analysis of a limiting case in which one set of dependent variables moves infinitely fast compared to the remainder. Singular orbits

are defined for this limiting system and a perturbation argument using isolating blocks allows one to find actual solutions. GRA

N75-32840# Wisconsin Univ., Madison. Mathematics Research Center.
CARDINAL t-PERFECT SPLINES
A. Sharma and J. Tzimbalario Mar. 1975 19 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010050; MRC-TSR-1529) Avail: NTIS CSCL 12/1

Cardinal t-perfect splines are introduced here as cardinal splines of degree m with leading term in (nu,nu, + 1) equal to t(nu) x (m), sup nu)(x sup m), all nu, as a connection between cardinal monosplines (t = 1) and cardinal perfect splines (t = -1). A cardinal t-perfect spline of minimal t-norm was determined for various choices of m and of the number s of continuous derivatives of the spline. An extremum problem for t-perfect cardinal splines is solved. GRA

N75-32841# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE CARDINAL SPLINE INTERPOLANT TO e SUP iut
Carl DeBoor Mar. 1975 23 p
(Contract DA-31-124-ARO(D)-462)
(AD-A010051; MRC-TSR-1533) Avail: NTIS CSCL 12/1

The cardinal spline interpolant S sub (n,u) of degree 'n' to exp(iut) is shown to satisfy absolute value of (S sub (n,u)(t)) less than 1 unless 't' is an interpolation point. It is shown that 1 is less than C sub n is less than 1 + 2 (1-n) for all odd 'n' and C sub n = 1 for all positive even 'n'. Author

N75-32842# Wisconsin Univ., Madison. Mathematics Research Center.
CHARACTERIZATION OF INCIDENCE ALGEBRAS
Robert B. Feinberg Mar. 1975 72 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010048; MRC-TSR-1454) Avail: NTIS CSCL 12/1

Incidence algebras and coalgebras of lower finite quasi-ordered sets are characterized abstractly. GRA

N75-32843# Wisconsin Univ., Madison. Mathematics Research Center.
WEAK CONVERGENCE FOR EXPONENTIAL AND MONOTONE LIKELIHOOD RATIO FAMILIES AND THE CONVERGENCE OF CONFIDENCE LIMITS
Bernard Harris and Andrew P. Soms Mar. 1975 21 p refs
Sponsored in part by Math. Inst. der Tech. Univ., Munich
(Contract DA-31-124-ARO(D)-462)
(AD-A010097; MRC-TSR-1272) Avail: NTIS CSCL 12/1

Two convergence theorems for one-sided confidence limits for exponential and monotone likelihood ratio families are given. In addition, for some special exponential families, the class of discrete limit distributions is characterized and a uniqueness result obtained. Examples of the above results are given. Applications to hypothesis testing and confidence limits are indicated. GRA

N75-32844# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
NONLINEAR FILTER REPRESENTATION VIA SPLINE FUNCTIONS
Richard S. Bucy and Hussein M. Youssef 1974 14 p
(Grant AF-AFOSR-2141-71; AF Proj. 9769)
(AD-A010279; AFOSR-75-0621TR) Avail: NTIS CSCL 12/1

An optimum nonlinear filter is realized by sequentially updating the spline coefficients of the relevant conditional distribution. The nonlinear filtering problem considered is that of phase demodulation with a two-dimensional phase process model. A multi-dimensional hyperbolic and polynomial spline basis are generated by a tensor product of one-dimensional bases. General conclusions about the spline approach for higher dimensional problems will be drawn. In particular, general running time projections for N-dimensional problems will be provided. Some timing results for various methods of tri-diagonal matrix inversion are reviewed. GRA

N75-32845# Wisconsin Univ., Madison. Mathematics Research Center.
A STRENGTHENED FORM OF TUTTE'S CHARACTERIZATION OF REGULAR MATROIDS Technical Summary Report
Robert E. Bixby Feb. 1975 16 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010094; MRC-TSR-1505) Avail: NTIS CSCL 12/1

The author proves that a binary matroid is regular if and only if it has no sub-matroid which is a series extension of a Fano matroid or its dual. GRA

N75-32846# Wisconsin Univ., Madison. Mathematics Research Center.
COMPUTING SMALL SOLUTIONS OF BURGERS' EQUATION BACKWARDS IN TIME Technical Summary Report
Alfred Carasso Mar. 1975 65 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010095; MRC-TSR-1525) Avail: NTIS CSCL 12/1

The author constructs and analyzes an algorithm for the numerical computation of Burgers: equation for preceding times, given an a-priori bound for the solution and an approximation to the terminal data. The method is based on the backward beam equation coupled with an iterative procedure for the solution of the non-linear problem via a sequence of linear problems. Also presented are the results of several numerical experiments. It turns out that the procedure converges asymptotically, i.e. in the same manner that an asymptotic expansion converges. This phenomenon seems related to the destruction. A-priori stability estimates are derived for the analytic backwards problem, and it is observed that in many numerical experiments, the distance backwards in time where significant accuracy can be attained is much larger than would be expected on the basis of such estimates. The method is useful for small solutions. Problems where steep gradients occur require considerably more precision in measurement. The algorithm is applicable to other semi-linear problems. GRA

N75-32847# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
LEAST SQUARE IDENTIFIABILITY OF DYNAMIC SYSTEMS
Kristner Martensson Aug. 1973 23 p refs
(Contract AT(04-3)-113; Grants NSF GP-29049; PHS-GM-16197)
(PB-241752/5; USC-113P71) Avail: NTIS HC $3.25 CSCL 12A

Sufficient conditions for local identifiability of parametric nonlinear dynamic systems are derived. It is assumed that the unknown parameters are determined by a least square method, and it is shown that uniqueness of the parameters is equivalent to complete observability of a linear time-varying dynamic system. The conditions are illustrated with numerical examples. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N75-32848 Carnegie-Mellon Univ., Pittsburgh, Pa.
STOCHASTIC MODELING AS A MEANS OF AUTOMATIC SPEECH RECOGNITION Ph.D. Thesis
James K. Baker 1975 114 p
Avail: Univ. Microfilms Order No. 75-19843

A simplified implementation of the DRAGON speech recognition system has been developed using knowledge of the sources A (acoustic-phonetic) and L (lexical), and some of the knowledge from the source S (syntactic-semantic). This implementation has been tested on 102 utterances from 5 interactive computer tasks. The size of the integrated Markov network representing the knowledge sources is 410, 702, 916, 498, and 2356 states, respectively, for the 5 tasks whose vocabulary sizes are 24, 66, 37, 28, and 194 words, respectively, and which have grammars of varying degrees of complexity. Since a complete optimal search is performed, the recognition time is independent of the amount of noise in the signal or the number of errors in intermediate recognition decisions. The system

correctly recognizes 49 percent of the utterances and correctly identifies 83 percent of the 578 words. Dissert. Abstr.

N75-32849 Michigan Univ., Ann Arbor.
A MATHEMATICAL THEORY OF MODELING AND SIMULATION Ph.D. Thesis
Guy Charles Corynen 1975 245 p
Avail: Univ. Microfilms Order No. 75-20319

A framework with which modelling and simulation problems can be precisely stated and analyzed has been developed. The treatment of modelling is founded on a definition of "model" which is interpretation-free in the sense that models or their prototypes may be arbitrary objects, and from a perspective where the modeller is required to state his 'view of the world'. Simulation is treated similarly and is considered as part of an experimental inquiry where it may be viewed as a sequential statistical experiment. Due to this statistical approach, special attention is devoted to the modelling of stochastic objects such as measure (probability) spaces, random variables and ergodic processes. Theorems which answer various modelling and simulation questions are also developed. Dissert. Abstr.

N75-32850# Naval Postgraduate School, Monterey, Calif.
KOLMOGOROV-SMIRNOV TEST FOR GROUPED DATA M.S. Thesis
Shuarto Darmosiswoyo Mar. 1975 39 p refs
(AD-A009906) Avail: NTIS CSCL 12/1

Herein is presented a Kolmogorov-Smirnov test for grouped samples. It constitutes an application of W.J. Conovers procedure, which was originally designed for calculating exact critical levels for test with discrete distributions. This test extends the goodness-of-fit test to samples which are grouped into intervals. Critical levels in the two-sided case were calculated to a close approximation. Some examples of the application of this extension of the Kolmogorov-Smirnov test are included and comparisons with the Chi-square test, the Kolmogorov-Smirnov test for continuous distribution and for grouped samples are made. Comparisons among the three goodness-of-fit tests based on the results of computer simulations are made. GRA

N75-32851# Naval Postgraduate School, Monterey, Calif.
PROBABILITY AND ITS APPLICATIONS TO ANTISUBMARINE WARFARE M.S. Thesis
Billy Joe Smith and Larry Wayne Vice Mar. 1975 99 p refs
(AD-A009913) Avail: NTIS CSCL 15/1

A basic course with applications of probability to ASW, the course consists of six lesson plans and a Study Guide. The lesson plans are designed to give the/an instructor guidance in what to teach, the depth required and objectives the student should be able to accomplish. The Study Guide provided is for the use of both the instructor and the student, and it should serve as a basic text for the course. Current ASW tactical publications were examined by the authors while developing the course, and as many of the probability applications and as much associated probability terminology from these sources as practicable (and when this could be accomplished at the unclassified level) are incorporated in the course. GRA

N75-32852# Army Materiel Command, Texarkana, Tex. Intern Training Center.
STATISTICAL ANALYSIS OF AMC ACCIDENT FREQUENCY RATES Final Report
Sami Hoxha Mar. 1975 57 p refs
(AD-A009414; USAMC-ITC-02-08-75-407) Avail: NTIS CSCL 13/12

The objective of the research is the investigation of the correlation of month, day, time of the day, age group and sex with accident frequency. This was done by using analysis of variance. One-way and two-way analyses of variance were employed to determine if there is a significant effect due to each variable and combination of variables. Also the interaction between the variables was tested. Day, time of day, sex and age group are found to have a significant effect on the accident frequency. However, month is found to have no significant effect on the accident frequency. GRA

N75-32853# Naval Postgraduate School, Monterey, Calif.
SEMI-MARKOV GENERATED POINT PROCESSES AND THE SUPERPOSITION OF FINITE NUMBERS OF INDEPENDENT ERLANG AND HYPEREXPONENTIAL RENEWAL PROCESSES Ph.D. Thesis
Richard Davies Haskell Jun. 1974 317 p refs
(AD-A009982) Avail: NTIS CSCL 12/1

The objective of this research has been to characterize in terms of spectral representations and interval distributions the univariate point process resulting from the superposition of a finite number of independent, identically distributed renewal processes with either Erlang or hyperexponential interval distributions. A corollary to the direct line of inquiry has involved a broad class of univarate point processes known as semi-Markov generated point processes. A semi-Markov generated point process may be thought of as a superposition of dependent renewal processes. The spectral and distributional characteristics are developed for such processes with finite state space, and the superposition of renewal processes with Erlang or hyperexponential interval distributions is shown to have an equivalent representation as a semi-Markov generated point process. Equivalence here refers to the probabilistic structure of the time between events, and more specifically, the spectral properties. GRA

N75-32854# Wisconsin Univ., Madison. Mathematics Research Center.
THE RELATION BETWEEN DISTANT INDIVIDUALS IN GEOGRAPHICALLY STRUCTURED POPULATIONS
Thomas Nagylaki Feb. 1975 16 p refs
(Contract DA-31-124-ARO(D)-462; Grants GM-15422; NSF MPS-72-00381-A01)
(AD-A010098; MRC-TSR-1515) Avail: NTIS CSCL 06/3

The equilibrium structure of a population distributed continuously and homogeneously in an infinite habitat is investigated. The analysis is confined to a single locus in the absence of selection, and every mutant is assumed to be new to the population. Asymptotic expressions are derived for the probability that two homologous gives separated by a given distance are the same allele for a migration function which decays at least exponentially in three dimensions and for one with an infinite variance in one dimension. GRA

N75-32855# Naval Research Lab., Washington, D.C.
AN ADAPTIVE FILTER STABILITY ANALYSIS
A. J. Verderese Apr. 1975 28 p refs
(NRL Proj. G05-16)
(AD-A010513; NRL-MR-3034) Avail: NTIS CSCL 12/1

An adaptive filter has been derived (Both continuous and discrete) which minimizes the mean square error without having prior knowledge of the statistics. The filter was simulated and shown to have excellent accuracy and settling characteristics for a variety of stationary conditions. In addition, the filter:s stability characteristics were explored via an analytical development and shown to be stable for the free system case, the uncorrelated case, as well as for the completely correlated case, provided the mean minus one-half the variance of the system coefficient is greater than zero. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N75-32856 Michigan Univ., Ann Arbor.
MODELING AND IDENTIFICATION OF RELATIVELY SLOWLY VARYING SYSTEMS Ph.D. Thesis
Philip Howard Fiske 1975 157 p
Avail: Univ. Microfilms Order No. 75-20342

A generic model was developed for nonlinear, time-varying, causal, and bounded systems; this model was formulated in terms of a finite set of parameters which adequately describe the unknown system mapping. Two separate models are considered for the variation in the parameters representing the system. In the first, the variation is assumed to be unknown but bounded between measurement times, and in the second, the variation between measurement times is taken to be random, with known mean and covariance. Two methods of processing

the observations are considered in each case: one is an off-line technique of processing the observations in batches, treating the system as if it were time-invariant within each batch, and analyzing the resultant errors; the other is an iterative identification procedure which can be used to continually update and improve the information about an unknown system as it operates. Dissert. Abstr.

N75-32857 Yeshiva Univ., New York.
ERGODIC THEORY IN STATISTICAL MECHANICS Ph.D. Thesis
Michael Aizenman 1975 107 p
Avail: Univ. Microfilms Order No. 75-20583

The ergodic properties of infinite systems of interacting particles were investigated by considering two simple systems. The basic concepts of ergodic theory and their relevance to the study of the dynamics of physical systems are reviewed; the framework is described in which the dynamic behavior of local observables was studied, and the ergodic properties of ideal gas are discussed. The infinite systems of hard rods were investigated, and it was found that under certain restrictions on the velocity distribution, the system is Bernoulli. The one dimensional mixture of several components of equal mass particles is analyzed, and equilibrium states of finite and infinite systems are characterized by a dynamic stability condition introduced by R. Haag. Dissert. Abstr.

N75-32858 State Univ. of New York, Buffalo.
A NEW APPROACH TO SIMULATION OF NONLINEAR SYSTEMS Ph.D. Thesis
Nibir Kanti Datta 1975 151 p
Avail: Univ. Microfilms Order No. 75-18788

Simulation techniques for handling differential-algebraic models were examined. Most of them utilize explicit integration schemes coupled with controlled step Newton-type iteration techniques. It was shown that for stability and accuracy, it is necessary to control the step size during integration as well as the iteration interval between successive applications of Newton-type iteration techniques. Error expressions were derived and used to successfully implement the algorithm. The step size and the iteration interval automatically adjust themselves to local conditions to meet the user specified error criterion. Extrapolative schemes were utilized to increase the computing efficiency. Dissert. Abstr.

N75-32859# California Univ., Berkeley. Operations Research Center.
COMPUTERIZED FAULT TREE ANALYSIS: TREEL AND MICSUP
Pradip K. Pande, Michael E. Spector, and Purnendu Chatterjee Apr. 1975 57 p refs
(Contract N00014-69-A-0200-1070; NR Proj. 042-238)
(AD-A010146; ORC-75-3) Avail: NTIS CSCL 14/4

Fault tree analysis has proven to be extremely useful in studying large scale systems in both industry and research. Due to the size and complexity of most trees, it has been necessary to develop computer programs for efficient analysis. Vessely and Narum developed a computer package called PREP and KITT in 1970. In 1974, Fussell, Henry and Marshall produced a program called MOCUS. The computer programs presented in this paper perform functions similar to the PREP and MOCUS codes, though the methodology and efficiency are greatly advanced. In addition, this paper provides a basic understanding of the terminology and concepts of fault trees, discusses planned objectives, and gives some insight into a topic called Tree Trimming. All concepts and explanations are illustrated by example. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N75-32860 Rochester Univ., N.Y.
ANALYTICAL CONTINUATION IN INFINITE DIMENSION AND REINHARDT SETS Ph.D. Thesis
Getulio Izidoro Katz 1974 79 p
Avail: Univ. Microfilms Order No. 75-15209

A positive answer is given to the Levi problem in the case of Riemann domains over Banach spaces. This result follows from investigations about properties of permanence for domains of existence under elementary set operations. Following Josefson, it is proved that a convex set in l sub p (A) (A any index set) is a domain of existence. This result stresses that the behavior of the space of polynomials is directly reflected in the answer to the Levi problem. It is proved that a pseudo-convex Reinhardt domain is sequentially holomorphically convex for certain nonseparable Banach spaces. Dissert. Abstr.

N75-32861 Notre Dame Univ., Ind.
SET THEORY IN INFINITARY LANGUAGES Ph.D. Thesis
Thomas L. Naps 1975 179 p
Avail: Univ. Microfilms Order No. 75-19947

Infinitary languages were used to obtain a way of characterizing models of set theory with respect to the axiom of choice. An ascending chain of infinitary extensions of ZF set theory was defined in such a way that the models which satisfy the respective extensions must also satisfy progressively stronger versions of the axiom of choice. Dissert. Abstr.

N75-32862 City Univ. of New York.
CLASS GROUPS OF REAL QUADRATIC NUMBER FIELDS Ph.D. Thesis
Paul Barry Massell 1975 56 p
Avail: Univ. Microfilms Order No. 75-19987

Examples are presented of some of the complex structures of classical class field theory: in particular, constructions of class groups in the field of rationals and in real quadratic fields. A 'skipping' phenomena and an E factor are defined as a way of distinguishing normal from special prime ideals. Connection is made to quadratic forms via the formula which relates the class number of a group of quadratic forms of given discriminant to the order of the corresponding ray class group. After the structure of ray class groups is found for powers of prime ideals, a study of their subgroup pattern yields some stability results which lead to formulas for the number of class groups of prime-power conductor in real quadractic fields. Dissert. Abstr.

N75-32863 Suomalainen Tiedeakatemia, Helsinki (Finland).
ON THE STABILIZATION OF 2-CATEGORIES
Kaj Malm 1975 45 p refs
(ISBN-951-41-0233-9) Copyright. Avail: Issuing Activity

After having established the needed results about 2-categories, the task of modifying Tierney's definitions in such a way that certain 2-categories can be stabilized is dealt with. Data are given which show that modifications do not affect underlying categories of the stabilized 2-categories; specifically, stable categories of Tierney enriched with 2-structure are given. The stable homotopy category was also studied. Author

N75-32864 Suomalainen Tiedeakatemia, Helsinki (Finland).
EXTREMAL PROBLEMS FOR FUNCTIONS WITH BOUNDED BOUNDARY ROTATION
W. E. Kirwan 1975 21 p refs
(ISBN-951-41-0211-8) Copyright. Avail: Issuing Activity

Solutions are found for the extremal problem for V sub k; the Julia variational formula and the Biernacki method were used to show that the extremal domain for the problem is a polygonal domain. M.J.S.

N75-32865 Suomalainen Tiedeakatemia, Helsinki (Finland).
ON LOCALLY AFFINE MAPPINGS OF RIEMANN SURFACES
Matti Lehtinen 1975 39 p refs
(ISBN-951-41-0232-0) Copyright. Avail: Issuing Activity

Locally affine mappings of Riemann surfaces were studied for their own sake and not in connection with any particular extremal problem. General properties of such mappings are first given in a unified fashion. It is shown that quasiconformal mappings can be approximated by locally affine mappings. The problems of existence of some special locally affine homeomorphisms between compact Riemann surfaces were investigated. It is proved that for K large enough there always exist locally affine mappings with maximal dilatation K between two given compact surfaces, and that there always exist locally affine

mappings for which part of the singular behavior is prescribed. Author

N75-32866# Wisconsin Univ., Madison. Mathematics Research Center.
DUALITY THEOREMS AND THEOREMS OF THE ALTERNATIVE
L. McLinden Feb. 1975 11 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010086; MRC-TSR-1319) Avail: NTIS CSCL 12/2

It is shown, in a completely general setting, that a theorem of the alternative is logically equivalent to a duality theorem linking two constrained optimization problems. GRA

N75-32867# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
ON OPEN LOOP AND CLOSER LOOP NASH STRATEGIES
Nils R. Sandell, Jr. 1973 7 p refs
(Grant AF-AFOSR-2273-72; AF Proj. 9769)
(AD-A010502; AFOSR-75-0716TR) Avail: NTIS CSCL 12/2

For deterministic nonzero-sum differential games, every open loop Nash strategy set is a closed loop Nash strategy set. The converse, that the open loop strategy set generated by a closed loop Nash strategy set is Nash, is false. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N75-32868# Polytechnic Inst. of New York, Brooklyn. Microwave Research Inst.
RESEARCH PROGRESS IN ELECTROMAGNETISM, QUANTUM ELECTRONICS, PLASMA PHYSICS, SOLID STATE, AND COMMUNICATION Scientific Interim Report, 15 Sep. 1973 - 14 Sep. 1974
Arthur A. Oliner Nov. 1974 416 p refs
(Contracts F44620-69-C-0047; F44620-74-C-0056; AF Proj. 4751)
(AD-A008813; POLY-MRI-452.39-74; PR-39; AFOSR-74-1922TR) Avail: NTIS CSCL 05/2

Contents: Electromagnetics and waveguide techniques; Quantum electronics and optics; Plasma physics and energy conversion; Solid state and materials; Communications and computers; Systems, control, and network theory. GRA

N75-32869# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TAMING A MAGNETIC FIELD
E. Margolin 25 Oct. 1974 13 p Transl. into ENGLISH from Sov. Molodezh (USSR), no. 112, 7 Jun. 1974 p 3
(AD-A001139; FTD-HC-23-2853-74) Avail: NTIS CSCL 20/9

A conference on the magnetohydrodynamics involving incompressible liquids is discussed. Topics discussed include self-excitation of a magnetic field, questions of ferrohydrodynamics, ferromagnetics, electromagnetic fields, and molten stells. M.J.S.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N75-32870 Catholic Univ. of America, Washington, D.C.
CREEPING WAVES AND LATERAL WAVES IN ACOUSTIC SCATTERING BY LARGE ELASTIC CYLINDERS Ph.D. Thesis
George Vladimir Frisk 1975 98 p
Avail: Univ. Microfilms Order No. 75-19527

The connection between creeping wave and flat surface wave theory was established by investigating the limit of acoustic scattering from a solid elastic cyclinder imbedded in a fluid, whose radius tends to infinity. The asymptotic behavior of the complex circumferential wave numbers was calculated by substituting the appropriate Debye- or Airy-type asymptotic expansions into the 3 x 3 secular determinant and solving it using iterative techniques. The creeping wave modes fall into two classes: (1) those with speeds close to the sound speed in the fluid (Stoneley and Franz waves) and (2) those with speeds close to the bulk wave speeds in the solid (Rayleigh and Whispering Gallery waves). Graphical results are presented for an aluminum cylinder in water for the complex wave number plane, phase velocities, and attenuations, all as functions of fluid wave number times cylinder radius. The results show good agreement with existing numerical results. Dissert. Abstr.

N75-32871*# Wyle Labs., Inc., Hampton, Va.
DETERMINATION OF ROTOR HARMONIC BLADE LOADS FROM ACOUSTIC MEASUREMENTS Final Report
Peter K. Kasper Washington NASA Oct. 1975 66 p refs
(Contract NAS1-12390)
(NASA-CR-2580) Avail: NTIS HC $4.25 CSCL 20A

The magnitude of discrete frequency sound radiated by a rotating blade is strongly influenced by the presence of a nonuniform distribution of aerodynamic forces over the rotor disk. An analytical development and experimental results are provided for a technique by which harmonic blade loads are derived from acoustic measurements. The technique relates, on a one-to-one basis, the discrete frequency sound harmonic amplitudes measured at a point on the axis of rotation to the blade-load harmonic amplitudes. This technique was applied to acoustic data from two helicopter types and from a series of test results using the NASA-Langley Research Center rotor test facility. The inferred blade-load harmonics for the cases considered tended to follow an inverse power law relationship with harmonic blade-load number. Empirical curve fits to the data showed the harmonic fall-off rate to be in the range of 6 to 9 db per octave of harmonic order. These empirical relationships were subsequently used as input data in a compatible far field rotational noise prediction model. A comparison between predicted and measured off-axis sound harmonic levels is provided for the experimental cases considered. Author

N75-32872*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN OBSERVATION ON TONE CUT-OFF IN STATIC TEST DATA FROM JET ENGINE FANS
Marcus F. Heidmann Washington Sep. 1975 7 p refs
(NASA-TM-X-3296; E-8409) Avail: NTIS HC $3.25 CSCL 20A

The far-field acoustic data for eight full-scale fans tested at a NASA-Lewis outdoor facility were analyzed for the effect of a cut-off design feature where the number of rotor and stator blades are proportioned so that the blade-passage tone will not propagate. Inlet flow distortions, prevalent during static testing, interact with the rotor to generate tones that generally mask this cut-off phenomenon. Distortion tone properties previously evaluated are used to analyze the tones propagating from the aft fan duct. The analyzed data clearly differentiated the fans that are and are not cut-off. Author

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N75-32873 Catholic Univ. of America, Washington, D.C.
PHONON-PHONON INTERACTIONS IN CHALCOGENIDE GLASSES Ph.D. Thesis
Regan Ellis Howard 1975 219 p
Avail: Univ. Microfilms Order No. 75-19530

Arsenic tri selenide and arsenic tri sulfide were chosen as high power laser window materials because of their chemical stability and their transparency in the far infrared region. It was expected that purification methods would reduce the residual absorption to acceptable levels by removing the arsenic tri oxide impurities. It was determined that the absorption could not be

reduced below a certain level which was subsequently identified as the multiphonon absorption intrinsic to the pure material. Using laser calorimetry, infrared spectroscopy, and electronic Raman scattering, attempts were made to determine the nature of the multiphonon absorption in these arsenic chalcogenide glasses. The mechanism thought to be responsible for the multiphonon absorption is that wherein incident photons interact with two or more phonons via the nonlinear electric moment of the lattice. Covalent bond charge distortion appears to be the source of these higher order electric moments.
Dissert. Abstr.

N75-32874 Florida Univ., Gainesville.
INTERPRETATION OF INFRARED INTENSITIES Ph.D. Thesis
James Henry Newton 1974 276 p
Avail: Univ. Microfilms Order No. 75-19372

The infrared intensity data for the methyl halides was interpreted in terms of the atomic polar tensors. By using the principle of isotopic invariance of the approximate quantum mechanical CNDO/2 technique, a unique sign choice for the vector delta p/delta Q's for CH3F and CH3Cl was determined. By analogy the signs for the vector delta p/delta Q's for CH3Br and CH3I were infered. The errors in the polar tensor elements were estimated by comparing the CH3X and CD3X tensors. In addition, a normal coordinate analysis of the CH3X and CD3X molecules was carried out to insure consistency in coordinate definitions. The magnitudes of the dipole moment change vectors, associated with the atomic polar tensors were shown to have smooth trends through the CH3X series, suggesting that these vectors may be predictable and transferable intensity parameters. The CNDO/2 results for CH3F and CH3Cl were critically analyzed and the absolute intensities, predicted by CNDO, are compared to the experimental data. In general, the results for CH3F are much better than for CH3Cl. Dissert. Abstr.

N75-32875 Columbia Univ., New York.
THE DYNAMICS OF ANISOTROPIC LIQUIDS Ph.D. Thesis
Joseph N. Kushick 1975 95 p
Avail: Univ. Microfilms Order No. 75-18402

An expression is derived which enables one, in principle, to determine the angular velocity correlation function for rotationally hindered materials from a spectroscopic measurement of the reorientation correlation function. The expression is tested on several model systems to illustrate its range of applicability. A series of studies is conducted to determine the relative influence of the repulsive and attractive parts of the interaction potential on the decay of velocity correlations. It is found that the use of the repulsive part of the potential alone preserves the qualitative features of the velocity correlation function, and results in a substantial saving of computer time. The dynamics of cooperative molecular reorientation is discussed from the point of view of light scattering spectroscopy. A theory is reviewed which relates the collective reorientation time to the single particle reorientation time. Cooperative reorientation is then observed in a number of model systems. Dissert. Abstr.

N75-32876 Columbia Univ., New York.
LASER STUDIES OF K2 FLUORESCENCE AND OF MACROMOLECULAR REACTION KINETICS Ph.D. Thesis
Rina Giniger 1975 118 p
Avail: Univ. Microfilms Order No. 75-18381

The necessity for the use of lasers in the study of two different fields of the Raman spectrum is treated. Raman electronic processes were studied using the high monochromatism of the laser for selective excitation of a significant fraction of molecules into specific rotational-vibrational levels of an upper electronic state. The very narrowness of the spectral distribution of the laser light makes it possible to observe the translational Raman process with its correspondingly very small shifts and widths. The application of the photon counting technique to the direct observation and measurement of the electronic state radiative lifetime of K sub 2 excited by a mode locked He-Ne laser is described. A theory is described for probing the reaction rates of chemically reacting systems in the presence of a static external electric field, by measuring its heterodyne light scattering spectrum. The reaction model chosen was the dimerization of a globular protein in water solutions. Dissert. Abstr.

N75-32877 Florida Univ., Gainesville.
ELECTRON SPIN RESONANCE SPECTROSCOPY OF INORGANIC AND BIOLOGICAL MOLECULES Ph.D. Thesis
Clifton Howard Durham, Jr. 1974 287 p
Avail: Univ. Microfilms Order No. 75-19329

Some NbO molecules, produced by the vaporization of a mixture of Nb metal and solid Nb2O5 or by passing O2 gas over hot Nb metal, were trapped in solid neon or argon at 4 K and investigated by electron spin resonance (ESR) and optical spectroscopy. Analysis of the ESR spectrum established that the molecule has a ground electronic state exhibiting large nuclear hyperfine splittings from interaction with the Nb-93(1=9/2) nucleus. Essentially all lines were accounted for as effectively delta M = 0, 1, 2 transitions (or as multiple trapping sites). The magnetic parameter b, found to be approximately 0.19/cm in the gas-phase optical spectrum, is here determined to be 0.165/cm. These magnetic parameters are in accord with the expected electronic properties of NbO (assuming the A-values are positive) and are compared with those of VO. Both NbO16 and NbO18 were investigated by optical spectroscopy and the spectra correlate well with gas-phase data. Dissert. Abstr.

N75-32878 Columbia Univ., New York.
ELECTRON TIME OF FLIGHT SPECTROSCOPY Ph.D. Thesis
David Eric Donohue 1975 114 p
Avail: Univ. Microfilms Order No. 75-18371

The integral cross section for the scattering of electrons by a number of molecules has been measured at electron energies from 0.2 to 1.6 eV using a novel time-of-flight spectrometer. In this technique, electrons are ejected from a sodium photosurface by a nanosecond pulse of light; they then traverse a scattering cell and their energy is deduced from the flight time between the photosurface and electron detector. The attenuation of the transmitted electron current as a function of flight time when a sample gas is introduced in the scattering cell yields the cross section as a function of energy. Dissert. Abstr.

N75-32879 California Univ., San Diego.
RESOLUTION OF CONTINUUM ELECTRONIC STATES WITH PHOTOFRAGMENT SPECTROSCOPY Ph.D. Thesis
Robert Douglas Arrigo Clear 1975 110 p
Avail: Univ. Microfilms Order No. 75-19620

The Franck-Condon principle was used to derive the angular orientation of the excited state of the asymmetric rotor. Results agree with the semiclassical derivations which are used to analyze photofragment angular distributions for triatomic molecules. The results of the photofragment spectra of I sub 2 and HI and DI, using the fourth harmonic of a neodymium laser are presented. The laser probes the C state of I2 and the A band in HI and DI. Individual absorption and excited state potential curves are presented. A discussion of the statistical problems, and techniques, including nonlinear curve fitting are also presented.
Dissert. Abstr.

N75-32880 Kentucky Univ., Lexington.
PREDICTION OF THE GEOMETRIES AND FORCE FIELDS FOR MOLECULES IN ELECTRONICALLY EXCITED STATES Ph.D. Thesis
I-Chen Chang 1974 148 p
Avail: Univ. Microfilms Order No. 75-18466

A rapid and accurate theoretical procedure to predict geometries was developed. A quadratically convergent approach to calculate the wave functions for open shell many-electron systems and a damped Newton-Raphson method to optimize all of the geometrical coordinates were employed. Applications of the procedure to a series of small molecules were carried out within the semiempirical INDO approximation. The predicted bond angles and bond lengths were in agreement with corresponding experimental data and previous calculations. Molecular force constants and vibrational frequencies were also obtained as by-products of the geometry optimization. A set of regression formulas was used to calibrate the predicted frequencies. Comparison of the predictions for the ground state and the excited

states of molecules yields qualitative information about the stability of these molecules. Dissert. Abstr.

N75-32881 Columbia Univ., New York.
MATTER IN SUPERSTRONG MAGNETIC FIELDS Ph.D. Thesis
Hsing-Hen Chen 1973 134 p
Avail: Univ. Microfilms Order No. 75-18365

In a magnetic field of order 10 to the 12th power Gauss, characteristics of neutron star models for pulsars, the atomic, molecular and crystalline forms of matter are radically different than those encountered in the laboratory. Because of the strong tendency of electrons to move along magnetic field lines, atoms greatly increase binding energies and cylindrical, rather than spherical, shapes. Molecules take the form of linear chains of atoms with the chains parallel to the magnetic field lines. A strong chain-chain interaction arises from the large atomic quadrupole moments; an approximately body-centered, cubic crystal lattice is formed from parallel chains. The physical properties of these atoms, molecules, and crystals were investigated. It was found that an iron lattice will be bound by about 10 keV per atom and have a density about 10,000 gm/cc. This kind of crystal may exist on neutron star surfaces and may have a significant influence on the pulsar magnetospheric structure. Dissert. Abstr.

N75-32882 Michigan Univ., Ann Arbor.
ENERGY LOSS OF ELECTRONS IN NITROGEN Ph.D. Thesis
John Louis Barrett 1975 83 p
Avail: Univ. Microfilms Order No. 75-20290

The spatial distribution of the energy deposited by kilovolt electrons moving through gaseous molecular nitrogen was measured. The range of electrons of initial energy 300 eV to 5 KeV was obtained and is expressed in a formula. The range, in this energy interval, is greater than that determined by previous measurements. The energy region (above 1 KeV) where the simpler expression R = KE(A)holds is discussed. It is shown that this is the energy region where the energy and range dependence of the energy deposition curve can be removed and a normalized energy deposition curve can be obtained. The efficiency of conversion of electron energy at 1 KeV and 280 microns pressure to energy of photons at 3914A was measured to be (0.28 + or - .03)%. Dissert. Abstr.

N75-32883 Michigan Univ., Ann Arbor.
THE TRANSPORT AND ENERGY LOSS EFFECTS OF CHARGED PARTICLES IN EMULSION RADIATION DETECTORS, VOLUMES 1 AND 2 Ph.D. Thesis
Michael James Flynn 1975 362 p
Avail: Univ. Microfilms Order No. 75-20344

The results of investigations into the basic physical processes involved in the exposure of film to charged particles are presented. Analytic models for the qualitative description of the response characteristics of emulsion radiation detectors are treated. The response of emulsions to charged particles was examined by deriving formula to predict the number of silver bromide grains sensitized per unit pathlength of a charged particle with a given energy. An analysis of charged particle transport describes the effects of energy straggling by equations of the Gaussian pathlength probability type. An numerical transport algorithm is presented which compromises accuracy and numerical speed to provide a description of intermediate complexity and broad versatility. Basic work was performed on charged particle stopping powers, and is discussed. Simple corrections to the Bethe equation which account for the effects of atomic binding on the mean energy lost in excitation collisions are included. Dissert. Abstr.

N75-32884 Columbia Univ., New York.
CORRELATION CORRECTION TO OSCILLATOR STRENGTHS: THE LITHIUM ISOELECTRONIC SEQUENCE Ph.D. Thesis
Leonard Irving Silver 1975 85 p
Avail: Univ. Microfilms Order No. 75-18439

A method designed to take into account correlation in atomic systems was derived. This method computes the correlation correction specific to the calculation of transition matrix elements, and the resulting exact equations contain only single particle operators instead of the usual two particle operators. The two particle operators enter only in the calculation of the matrix element in a straightforward integration. The method is applied to dipole transitions (among the four lowest states) in the Li isoelectronic sequence. Dissert. Abstr.

N75-32885 Princeton Univ., N.J.
REGGE TRAJECTORIES IN THE AMATI-BERTOCCHI-FUBINI-STANGHELLENI-TONIN MULTIPERIPHERAL MODEL Ph.D. Thesis
Owen Henry Nevett Saxton 1974 158 p
Avail: Univ. Microfilms Order No. 75-20658

The Regge trajectory structure was investigated analytically in the simple ABFST mode for the absorptive part of the scattering amplitude of two scalar particles. The integral transforms of Abarbanel and Saunders needed to diagonalize the integral equation in the forward and in the non-forward cases are presented. The connection between the two transformed amplitudes is established, and this shows the existence of Toller families of trajectories. A discussion is given of how a pole in the transform variable in either of these amplitudes leads to Regge behavior of the full amplitude. Simple solutions are given for the zero-mass case. Fredholm techniques are given for the case of a general mass of the exchanged particle, where a weak coupling approximation to the trajectories is given. The results are fully consistent with the previously-treated special cases of forward scattering and of zero exchanged mass. Dissert. Abstr.

N75-32886 Princeton Univ., N.J.
NON-ABELIAN GAUGE THEORIES AND ASYMPTOTIC FREEDOM Ph.D. Thesis
Frank Anthony Wilczek 1974 70 p
Avail: Univ. Microfilms Order No. 75-20674

The concept of asymptotic freedom was applied to quantum field theories and to physical reality. Asymptotic freedom is first defined and the simplest asymptotically free theories are presented; these are the theories with fermions coupled to a simple non-Abelian gauge field. The external field problem for the Yang-Mills theory is then considered. A general method for solving this problem is presented and the propagator is worked out in a variety of gauges. A simple form for the effective Lagrangian results in a specially chosen gauge. The effective Lagrangian obeys a renormalization group equation, and asymptotic freedom allows us to construct a good approximation for strong external fields. It is shown how corrections to sum rules may be calculated in asymptotically free theories; an application is made to the Callan-Gross sum rule. Dissert. Abstr.

N75-32887 California Inst. of Tech., Pasadena.
APPLICATIONS OF THE EQUATIONS OF MOTION METHOD Ph.D. Thesis
Danny Lee Yeager 1975 289 p
Avail: Univ. Microfilms Order No. 75-20014

Several applications of the equations of motion method for closed shell around states are discussed. A formalism is developed for studying intraexcited state transition densities. The calculated excitation energies and oscillator strengths agree well with experiment and suggest explanations for some unusual features recently observed in the optical absorption and electron scattering spectrum in the vacuum ultraviolet. A straightforward scheme is developed for extending the equations of motion formalism to systems with simple open shell ground states. A simple method for directly calculating ionization potentials and electron affinities is discussed. Formulas are given through third order in interaction matrix elements and described in detail. A computer program written in FORTRAN IV, which has the ability to derive formulas for second quantized excitation operators and Hamiltonians or various one-body and two-body operators using correlated or uncorrelated Hartree-Fock ground states, is described and listed. Dissert. Abstr.

N75-32888*# Alabama Agricultural and Mechanical Coll., Normal. Dept. of Physics and Mathematics.
SUPERRADIANT EFFECTS ON PULSE PROPAGATION IN RESONANT MEDIA Final Report, Sep. 1974 - Sep. 1975
ChingTsung Lee Sep. 1975 17 p refs
(Grant NsG-8011)

(NASA-CR-119141) Avail: NTIS HC $3.25 CSCL 20H

Adopting the so-called genealogical construction, the eigenstates of collective operators can be expressed corresponding to a specified mode for an N-atom system in terms of those for an (N-1)-atom system. Matrix element of a collective operator of an arbitrary mode is presented which can be written as the product of an m-dependent factor and an m-independent reduced matrix element (RME). A set of recursion formulas for the RME was obtained. A graphical representation of the RME on the branching diagram for binary irreducible representations of permutation groups was then introduced. This gave a simple and systematic way of calculating the RME. Results show explicitly the geometry dependence of superradiance and the relative importance of r-conserving and r-nonconserving processes and clears up the chief difficulty encounted in the problem of N two-level atoms, spread over large regions, interacting with a multimode radiation field. Author

N75-32889# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

KINETIC EQUATION FOR DENSE GASES WITH THE ACCOUNT OF ATTACKING FORCES BETWEEN MOLECULES

L. A. Paltsev 24 Jan. 1975 27 p refs Transl. into ENGLISH from Tsent. Aerogidigrodinamicheskii Inst. Uch. Zap. (USSR), v. 11, no. 5, 1971 p 49-55

(AD-A007229; FTD-MT-24-308-75) Avail: NTIS CSCL 07/4

The kinetic equation is derived under the assumption that the potential function of intramolecular interaction monotomically decreases with the distance. Expressions are given for the integrals of paired and triple collisions. M.J.S.

N75-32890# Office of Naval Research, London (England).

LIGHT SCATTERING STUDIES OF MOTION IN MOLECULAR SYSTEMS QUANTUM ELECTRONICS DIVISION OF THE EUROPEAN SOCIETY

Raymond D. Mountain 21 Feb. 1975 14 p refs Conf. held at Verbier, Switzerland, 16-20 Dec. 1974

(AD-A007145; ONRL-C-75) Avail: NTIS CSCL 07/4

The more than 100 scientists from around the world who participated in this landmark conference heard 14 invited papers and 46 contributed papers. Three fourths of the papers were primarily experimental with the remaining one fourth either theoretical or review papers. The topics discussed were: liquid crystals, basic scattering properties of fluids, molecular reorientation and depolarized scattering, viscoelastic media, flow and turbulence, surfaces, critical phenomena, biological systems and macromolecules, nonlinear scattering and charged scatterers. The diversity of topics is indicative of the extent to which laser as a light scattering plus Doppler shift interferometry have developed as a versatile measurement method. The techniques of the method are now reasonably well understood so the emphasis is on tailoring measurements to specific applications. This will require the professional involvement of light scattering experts with specialists in a wide variety of disciplines. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N75-32891*# Kanner (Leo) Associates, Redwood City, Calif.

RESULTS OF OPTIMIZATION CALCULATIONS FOR A FINNED TUBULAR FUEL ELEMENT IN A GAS-COOLED HEAVY-WATER REACTOR

M. Halouzka Washington NASA Sep. 1975 49 p Transl. into ENGLISH from Czechoslovakian Report UJU-184C, Dec. 1967 42 p

(Contract NASw-2790)

(NASA-TT-F-16561; UJU-184C) Avail: NTIS HC $3.75 CSCL 18I

The optimization of a tubular fuel element with longitudinally finned tubes is described. The fins are of rectangular shape. Fuel element radius, element fuel underfill, height of fins and the overall pressure drop along the coolant channel are considered to be independent variables. The method of physical calculations is described. The results are presented in graphic form and are used for a technological optimization of a number of tubes in a fuel element, and for determination of an optimum range of independent variables. Some selected variants of the element are given. Author

N75-32892*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A TWO-PARAMETER SCINTILLATION SPECTROMETER SYSTEM FOR MEASUREMENT OF SECONDARY PROTON, DEUTERON, AND TRITON DISTRIBUTIONS FROM MATERIALS UNDER 558-MeV-PROTON IRRADIATION

Sherwin M. Beck Washington Oct. 1975 64 p refs

(NASA-TN-D-7925; L-9941) Avail: NTIS HC $4.25 CSCL 20H

A two-parameter scintillation spectrometer system developed and used to obtain proton, deuteron, and triton double differential cross sections from materials under 558-MeV-proton irradiation is described. The system measures both the time of flight of secondary particles over a 488-cm flight path and the energy deposited in a scintillator, 12.7 cm in diameter and 30.48 cm long. The time resolution of the system is 0.39 nsec. The calculated energy resolution based on this time resolution varies with energy from 1.6 precent to 7.75 percent for 50- and 558-MeV protons. Various systematic and statistical errors are evaluated, and the double differential cross sections for secondary proton and deutron production at 20 deg from a 2.35 g/sq cm thick beryllium target are shown as an example of the results obtainable with this system. The uncertainly in the cross sections for secondary protons varies with particle energy from approximately + or - 9 percent at 50 MeV to approximately + or - 11 percent at 558 MeV. Author

74 OPTICS

Includes light phenomena.

N75-32893 California Inst. of Tech., Pasadena.

SPATIAL AND SPECTRAL BEHAVIOR OF SPECKLE IN AN IMAGING SYSTEM Ph.D. Thesis

Richard Devern Samuels Melville, Jr. 1975 130 p

Avail: Univ. Microfilms Order No. 75-20003

The speckle interference pattern that results when coherent illumination is reflected from or transmitted through a medium which causes random phase changes in the illumination was studied. The effect of polarization of the illumination, the first order statistics of speckle intensity, and the autocorrelation of speckle intensity as a function of space and wavelength variables were measured. The relationship between the amount of depolarization of a plane polarized input in transmission through opal glass diffusers of various thicknesses was measured, as well as the effect of this phenomenon on the first and second order statistics of speckle intensity. The autocorrelation of speckle intensities was calculated and measured as a function of the spatial dimension of the speckle pattern and the wavelength of the illumination. The spatial behavior depends upon the limiting aperture of the optical system, and the wavelength dependence is a function of the roughness of the diffuser. Dissert. Abstr.

N75-32894*# National Aeronautics and Space Administration. Pasadena Office, Calif.

LIGHTWEIGHT REFLECTOR ASSEMBLY AND METHOD Patent Application

Maurice J. Argoud (JPL), Jack Jolley (JPL), and Walter L. Walker, inventors (to NASA) (JPL) Filed 24 Sep. 1975 29 p

(Contract NAS7-100)

(NASA-Case-NPO-13707-1; US-Patent-Appl-SN-617202) Avail: NTIS HC $3.75 CSCL 20F

An invention for a lightweight solar reflector assembly having a glass cellular substrate and a method of formimg the reflector assembly was described. The novelty of the invention appears to reside in the method of forming a large low cost reflective surface for use in a solar concentrator or antenna. The invention

also includes the reflective component combination of a lamina glass reflective surface and a lightweight cellular glass substrate having the same coefficient of thermal expansion to provide a high quality optical reflective surface. Author

N75-32895# TRW Systems Group, Redondo Beach, Calif.
FEASIBILITY DEMONSTRATION OF OPTICAL DETECTION OF LOW FREQUENCY SOUND Final Report
J. H. Cole, J. A. Cunningham, and R. L. Johnson 21 Mar. 1975 83 p refs
(Contract N00014-73-C-0428; NR Proj. 240-033; RF34371001)
(AD-A009424; TRW-AT-SVD-TR-75-5) Avail: NTIS CSCL 17/8

Analysis and experiments were performed to demonstrate the feasibility of optical detection of low frequency sound. Both amplitude and phase detection were examined and in each case experimental results substantiated theoretical predictions. The interferometer (phase detection) technique was found superior to the beam steering (amplitude modulation) technique due to the former's frequency independence and greater sensitivity. Theoretical extrapolation of experimental results to parameter values not achievable with available laboratory equipment indicate a practically achievable sensitivity of -80 db (re 1/micro bar) per meter path length for phase detection. GRA

N75-32896# Metavac, Inc., Flushing, N.Y.
PRODUCTION ENGINEERING MEASURES FOR FILTER, INFRARED, INTERFERENCE-ABSORPTION TYPE Quarterly Report, 1 Dec. 1974 - 28 Feb. 1975
John Monte 10 Apr. 1975 22 p refs
(Contract DAAB07-74-C-0379)
(AD-A010359; QR-3) Avail: NTIS CSCL 20/6

The third quarter was devoted to the preparation of five Engineering Samples of Infrared Filters for the AN/VSS-3A searchlight. Coated filter elements were selected which passed the spectral transmission and figure of merit tests. The filter elements were assembled and all the required tests per specification C 2a 2204010306 were performed. These filters, along with their test data, will be submitted as item 0001AA, per contract. GRA

N75-32897# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISSOCIATION AND DECREASE OF LIGHT ABSORPTION OF A MULTILEVEL MOLECULAR GAS UNDER THE EFFECT OF THE RADIATION OF A POWERFUL CO2 LASER
N. V. Karlov, N. A. Karpov, Yu. N. Petrov, and O. M. Stelmakh 20 Nov. 1974 21 p refs Transl. into ENGLISH from Zh. Eksp. Teor. Fiz. (USSR), v. 64, no. 6, 1973 p 2008-2016
(AD-A003024; FTD-MT-24-1498-74) Avail: NTIS CSCL 07/4

The interaction of a powerful infrared radiation with the resonance absorbing gases is investigated. Examined is a cascade radiation-collision mechanism of the vibrational excitation of the molecular resonance system, which leads to the dissociation and decrease of light absorption of the gas. The propagation of the irradiating radiation in the medium is accompanied by transparency dissociation and recombination waves. The conducted experiments on the absorption of 10.6 micrometer radiation in BCl3 and SF6 gases made it possible to calculate the characteristic times of the transmission of excitation in the cascade process in these gases and also estimate the distribution of populations of molecules according to vibrational levels and the degree of dissociation. GRA

N75-32898# Boeing Co., Seattle, Wash. Military Aircraft Systems Div.
AIRBORNE VISUAL ACQUISITION OF GROUND TARGETS. PERFORMANCE IMPROVEMENT WITH HEAD UP PREDESIGNATION
Walter E. Leininger Sep. 1970 97 p
(AD-A010274; D162-10310-1) Avail: NTIS CSCL 17/8

Operational experience, previous flight tests, and simulation tests have demonstrated both the requirements and the potential for performance improvement in airborne visual acquisition of ground targets. Performance improvement with head-up predesignation was measured by means of a dynamic part-task low-altitude, high-speed visual flight simulation. Significant improvement was shown in probability of acquisition, range of acquisition, and search performance ratios. Improvements in performance are of sufficient magnitude to have an important effect upon weapon delivery probability on small tactical targets, and standoff capability on more highly defended strategic or interdiction targets. GRA

N75-32899# Range Commanders Council, White Sands Missile Range, N.Mex. Optical Systems Working Group.
OPTICAL INSTRUMENTATION Final Report
Dec. 1969 28 p
(AD-A010317) Avail: NTIS CSCL 20/6

The report discusses current development activities, and presents general information regarding optical instrumentation. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N75-32900 Tennessee Univ., Knoxville.
A CONTROL STRATEGY FOR PLASMA EQUILIBRIUM IN A TOKAMAK Ph.D. Thesis
Ronald Vincent Miskell 1975 125 p
Avail: Univ. Microfilms Order No. 75-18975

A state variable model of a Tokamak thermonuclear device, suitable for application of modern control theory techniques, was developed. The model considers eddy currents in the conducting shell surrounding the torus and the classical Shafranov equilibrium equation. The equations necessary to characterize the operating conditions of a Tokamak are cast in state variable form. Two control variables are selected, the vertical field current and the plasma temperature. The figure of merit chosen minimizes the shift of the plasma within the torus and considers position perturbations necessary to maintain the dense and hotter portions of the plasma profile in the center of the torus. The model uses a Kalman filter to estimate unmeasured state variables, and uses the second variation of the calculus of variations to maintain an optimal control path. The model was tested with data obtained from an operational Tokamak system, and the study showed that online modern control theory techniques can be applied to Tokamak systems to attain desired plasma equilibrium positions. Dissert. Abstr.

N75-32901 Florida Univ., Gainesville.
NEUTRON DIAGNOSTICS OF CONTROLLED THERMONUCLEAR PLASMAS
Finis Hio Southworth 1974 98 p
Avail: Univ. Microfilms Order No. 75-19392

The relatively untouched field of neutron diagnostics for controlled thermonuclear plasmas is attacked from various vantage points. Methods of determining the density radius product, rho R, of a laser induced plasma are presented. These are the first methods published of diagnosing rho R using the emitted neutrons from the plasma. One method relies on the ratio of the relative amount of neutrons emitted from D(d,n)He(3) reactions to those from the D(t,n)He(4) reaction in a initially pure deuterium plasma. The other method uses the ratio of the unscattered neutron flux emitted from the laser induced plasma to the scattered and hence energetically degraded neutron flux. Ion temperature can be determined through implementation of two other derived methods. One utilizes the relative neutron flux from differing reactions within a Maxwellian plasma while the other uses the energy spectrum of the neutrons emitted from a particular reaction. Extensions of the latter method give the neutron spectrum for non-thermonuclear neutron sources in laser induced plasmas and the Two Component Tokomak. Dissert. Abstr.

N75-32902 Florida Univ., Gainesville.
A KINETIC THEORY OF SPECTRAL LINE BROADENING IN PLASMAS Ph.D. Thesis
Thomas William Hussey 1974 107 p
Avail: Univ. Microfilms Order No. 75-19346

A formal kinetic theory was used to cast the line shape

function into a form that, while similar to the unified theories of Smith, Cooper, and Vidal and of Voslamber, does not introduce some of the usual approximations. The resulting line shape function explicitly includes the initial correlations between the atom and perturbers, and also demonstrates the natural separation of plasma mean field and collisional effects. The classical path and no-quenching approximations are discussed and ultimately employed. The weak coupling limit is considered as a systematic approximation to the formal results. It is shown that different ways of applying this limit lead to different expressions for the memory operator, some of which correspond to existing theories. One approximation is considered which systematically incorporates the effects of electron correlations within the framework of a unified theory. A practical approximation suitable for a strongly interacting plasma is discussed. Dissert. Abstr.

N75-32903 Catholic Univ. of America, Washington, D.C.
AN INVESTIGATION OF THE PRODUCTIONS OF PLASMAS FROM LIQUID DROPLETS Ph.D. Thesis
Howard Andrew Macewen 1975 300 p
Avail: Univ. Microfilms Order No. 75-20049

Since laser plasmas were not created using small, transparent liquid bodies as targets, a preliminary investigation into the phenomena that arise in such plasmas was undertaken. Small (0.1 mm to 1.0 mm diameter) droplets of water freely falling in a partial vacuum (.1 atm to .7 atm) were irradiated by a Q-switched ruby laser (around 10 Mw power at 6943 A wavelength). The resultant plasma was highly asymmetric; an initial expansion away from the laser was immediately followed by an expansion back towards the laser. Using a moderately simple computer model, these phenomena are generally explainable in terms of classical geometrical optics, which requires an early focusing of the incident radiation to very high energy densities near the back side of the target droplet. Dissert. Abstr.

N75-32904 Princeton Univ., N.J.
INVESTIGATIONS OF ANOMALOUS PROCESSES ASSOCIATED WITH THE LOWER HYBRID WAVES Ph.D. Thesis
Cheng Chu 1974 143 p
Avail: Univ. Microfilms Order No. 75-20621

Some plasma phenomena associated with the lower hybrid wave were investigated by means of 2-1/2D computer experiments. It was found that the electron transport rates (heat and momentum) are enhanced above the classical collisional values even for plasmas very close to thermal equilibrium. The enhancement is due to electron turbulent motion in the field of thermally excited lower hybrid waves. Employing a fluid model and by including a turbulent viscous term in the electron momentum equation, linear theory gives predictions which are in reasonably good agreement with the observed lower hybrid wave damping. Existing strong turbulence plasma theories give predictions which are not in agreement with the observations. In the presence of a long wavelength, large amplitude pump wave with a frequency close to the lower hybrid frequency, the plasma is subject to parametric instabilities. The parameteric decay instability is associated with the excitation of a short wavelength ion acoustic wave and a short wavelength lower hybrid wave. Dissert. Abstr.

N75-32905 Columbia Univ., New York.
PARAMETRIC EXCITATION OF PLASMA INSTABILITIES WITH A DENSITY MODULATED RELATIVISTIC ELECTRON BEAM Ph.D. Thesis
Bamandas Basu 1975 113 p
Avail: Univ. Microfilms Order No. 75-18355

Parametric electrostatic instabilities in a non-relativistic, stationary plasma excited by a monoenergetic, relativistic electron beam with density sinusoidally modulated along the direction of the beam flow have been theoretically investigated using a multiple-time-scale perturbation expansion method. The linear growth rate and the width of the spectrum of parametrically excited unstable beam-synchronous and high frequency electron plasma oscillation modes have been determined. For a given beam to plasma density ratio, there exists an upper limit to the initial beam kinetic energy for which the instabilities can be excited. Within the allowed range, maximum growth rate exhibits a minimum as the beam energy increases from its non-relativistic value. The feedback effect of the instabilities on the beam and the plasma electrons has also been calculated within the framework of the multiple-time-scale approach. Energies lost by the beam and transferred to the field oscillations were estimated. Dissert. Abstr.

N75-32906 California Inst. of Tech., Pasadena.
CYCLOTRON HARMONIC EMISSION IN A PENNING DISCHARGE Ph.D. Thesis
John Bernard Wilgen 1975 267 p
Avail: Univ. Microfilms Order No. 75-20013

Microwave noise emission at the harmonics of the electron cyclotron frequency from the magnetized plasma column of a Penning discharge was investigated experimentally, using oxygen in a variety of discharge configurations. It is found that grid stabilization of the plasma column has very little effect on the emission spectrum. Measurements of the shape and location of the harmonic emission lines are described in detail. It is concluded that the existence of a hybrid layer somewhere on the plasma column is a necessary condition for the observation of harmonic emission. The relaxation time and the cathode voltage dependence of the harmonic emission were investigated using a pulse modulation technique. High intensity nonharmonic radiation is observed and identified as resulting from a beam-plasma wave instability. It is found that the collective experimental results are in reasonable agreement with the single particle electrostatic radiation theory of Canobbio and Croci. Dissert. Abstr.

N75-32907# United Kingdom Atomic Energy Authority, Culham (England). Research Group.
PERFORMANCE DEMONSTRATION OF A FIELD EMISSION THRUSTER Final Report
K. L. Aitken, D. K. Jefferies, N. A. Pashley, R. S. Peckover, and R. Clampitt Oct. 1973 140 p refs Sponsored by ESRO (CLM/RR/E1/16; ESRO-CR(P)-437; ESTEC-1718/72-AA) Avail: NTIS HC $5.75

Fabrication of emitter arrays is described. Techniques discussed include: brazing of coil wound wires; sintering of coil wound wires; joining of coil wound wires by coating with metal, either by sputtering or chemical vapor deposition; and forming by plating. Apparatus constructed to test the arrays and to measure thrust, mass flow rate, and efficiency of a prototype thruster is described. Electroformed nickel wires formed into 3 cm emitter arrays were tested. Experimental results are reported in the following areas: temperature dependence of ion emission; comparison of emitter performance; sputtering and erosion; angular distribution and beam defocusing; current density distribution; stability of ion emission; and wetting and surface cleanliness. J.M.S.

N75-32908# Cornell Univ., Ithaca, N.Y.
STUDIES ON HEATING OF A PLASMA BY STRONG TURBULENCE AND RELATIVISTIC ELECTRON BEAM Final Report, 1 Jul. 1971 - 30 Jun. 1974
Charles B. Wharton 30 Jun. 1974 61 p refs
(Contract N00014-67-A-0077-0022)
(AD-A001380) Avail: NTIS CSCL 20/9

Contents: Summary of turbulent heating contributions--plasma resistivity during turbulent heating; ion energy distribution for turbulent heating; saturation of turbulent heating; Summary of contributions: relativistic electron beam--diode and beam characteristics; plasma heating with foil-less diode REB; plasma heating with foil-anode diode REB; beam interaction with turbulent plasma; Diagnostic developments--neutral atom beam experiments; optical line broadening; ruby laser scattering. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N75-32909 Case Western Reserve Univ., Cleveland, Ohio.
EFFECTS OF HIGH TEMPERATURE ANNEALING ON MNOS DEVICES Ph.D. Thesis
James Anthony Topich 1975 121 p
Avail: Univ. Microfilms Order No. 75-19252

Metal nitride oxide semiconductor (MNOS) devices were studied. The devices were fabricated using the thin native oxide present on silicon after normal cleaning procedures, and a silicon nitride layer deposited by the pyrolitic reaction of silane and ammonia at 700 C. The samples were then annealed for various times at temperatures between 800 and 1000 C. Results indicate that: (1) the conductivity of the silicon nitride layer increases with annealing time, (2) the positive dielectric charge is reduced with annealing time, and (3) the decay rate of switched MNOS memory devices increases with annealing time. Results also indicate that the same physical changes in the silicon nitride are responsible for both of these phenomena. It was proposed that the main effect of the annealing on the structure of the silicon nitride is to increase the number of charge carrier traps in the layer. These traps are believed to be associated with small crystalline regions in the otherwise amorphous film.
Dissert. Abstr.

N75-32910 Michigan Univ., Ann Arbor.
THE MAGNETO-OPTIC PROPERTIES OF ULTRA-THIN MAGNETIC FILMS Ph.D. Thesis
William Wolsey Raymond 1975 265 p
Avail: Univ. Microfilms Order No. 75-20430

From a study of the magnetic and optical properties of the gyromagnetic materials presently available, a set of characteristics was selected as a guide in the search for the most suitable medium. On this basis an experimental program was conducted of the thin film properties of the nickel-iron-cobalt ternary system. This led to the selection of the .65Fe/.35Co composition which has the highest intrinsic Faraday rotation of all presently known materials at room temperature. A vacuum deposition fabrication technique was refined to produce a material with less than one degree spread in the uniaxial magnetic anisotropy axis and a low coercive force. Local antiparallel domains printed on a film initially in a single domain state are nonvolatile. A study of the boundary value problem of the scattering matrix in the longitudinal and polar orientations of the magnetization led to the development of a minimum embedment structure which produces the maximum magneto-optic scattered field. Dissert. Abstr.

N75-32911 Duke Univ., Durham, N.C.
A MODEL OF INDIRECT EXCHANGE FOR AN ANTIFERROMAGNETIC SEMICONDUCTOR Ph.D. Thesis
Rajinder Mohan Gupta 1975 60 p
Avail: Univ. Microfilms Order No. 75-19163

A theoretical model of indirect exchange for an antiferromagnetic semiconductor is presented. The model is derived as an extension of the RKKY theory for metals and the Bloembergen and Rowland model for semiconductors, and is valid for a two interpenetrant sublattice antiferromagnetic semiconductor. The RKKY theory for treating ferromagnetism in metals is described in considerable detail starting from the localized spin-conduction electron spin interaction. The exchange Hamiltonian for the RKKY model is derived from the basic interaction by using operator transformations in second quantized notation. Expressions are derived for the two sublattice molecular field constants and the exchange constant /J(0)/ between the localized spins and the conduction electron spins. The magnitude of the exchange constant /J(0)/ is estimated from the derived relationships using the available experimental data for Gd2Se3. Dissert. Abstr.

N75-32912 California Univ., San Diego.
THE FREQUENCY DEPENDENCE OF THE CONDUCTION ELECTRON SPIN RESONANCE IN ALUMINUM, COPPER, AND SILVER Ph.D. Thesis
Daniel Lubzens 1975 116 p
Avail: Univ. Microfilms Order No. 75-19634

Conduction electron spin resonance (CESR) experiments were performed using pure samples of aluminum, copper, and silver. The experiments were done at three frequencies: 1.27 GHz, 9.2 GHz, and 35 GHz, using the transmission technique. For all the metals studied the CESR linewidth was found to be frequency dependent. In aluminum variations in the g-value were observed in measurements at 35 GHz. Attempts were made to explain the frequency dependence of the linewidth and g-value as a consequence of the g-anisotropy of the electronic g-value over the Fermi surface. The consequences of both motional narrowing and many body interactions between the electrons were incorporated in the analysis of the observed data. The analyzed data of copper and silver fit well to a reasonable amount of g-anisotropy and to a scattering time close to the one obtained from resistivity measurements. In aluminum an analogous attempt to fit the experimental results to the theory did not result in a self consistent set of parameters. Dissert. Abstr.

N75-32913 Kentucky Univ., Lexington.
FAST NEUTRON IRRADIATION EFFECTS ON DRIFT MOBILITY OF HOLES IN N-TYPE GERMANIUM AND SILICON Ph.D. Thesis
Ahmed Abdel-Hamid El-Difrawi 1974 162 p
Avail: Univ. Microfilms Order No. 75-18477

It is indicated that the measured mobility is a result of two mobilities, one being associated with the bulk and the second being associated with the surface and of a higher value than that of the bulk. A partial separation between the two components was obtained in cases where there were enough carriers in each main path to be collected and enough difference in the mobilities. The relative contribution of these two components is a function of emitter contact characteristics, distance between emitter and collector, temperature, sample purity, carrier injection concentration, and neutron irradiation. An explanation for the previous contradictions was found, and it was shown that the bulk mobility decreases with irradiation. An explanation was found for a mobility field dependence, half-width dependence on carrier injection concentration, discontinuity in the slope of the mobility vs temperature relation, and a variation of collected pulse half-width with the transit-distance. It was found that there is a surface contribution to the hole mobility in silicon which increases with radiation, as can occur in the case of germanium. Dissert. Abstr.

N75-32914 California Inst. of Tech., Pasadena.
NONEQUILIBRIUM PROPERTIES OF SUPERCONDUCTING-NORMAL METAL BOUNDARIES Ph.D. Thesis
David William Palmer 1975 186 p
Avail: Univ. Microfilms Order No. 75-20008

Three different nonequilibrium states of superconductivity were experimentally investigated. The experiments included studies of: (1) the electron transport properties across the interface of a single superconductor and a normal metal, (2) electron transport between two weakly coupled superconductors, and (3) electron transport through periodic arrays of hundreds of weakly coupled superconductors. Most emphasis was given to quantum interference effects. All three nonequilibrium states produced time dependent voltages which were investigated both by inducing step structure on the I-V characteristics with external microwave radiation, and by directly measuring the internal oscillating potentials. Josephson's relationship between frequency and voltage was found to be signficantly modified in certain well defined circumstances. Thin films of soft, hard, and compound superconductors were used. All results can be described using concepts of macroscopic quantum mechanics and simple equivalent circuit representations for the nonequilibrium electron state. Macroscopic wave function boundary conditions and coupling effects were examined with particular emphasis on characteristic coupling energy, decay lengths, healing time, and thermal constants. Dissert. Abstr.

N75-32915 Rhode Island Univ., Kingston.
ELECTRICAL AND OPTICAL PROPERTIES OF AMORPHOUS SEMICONDUCTORS Ph.D. Thesis
Dilip Kumar Paul 1974 323 p
Avail: Univ. Microfilms Order No. 75-17870

Electrical, optical, and structural properties of a few tetrahedrally coordinated amorphous semiconducting materials (TCAS) and their mixed systems (among those investigated are Ge, Si, Ge-Si, GaAs, GaP, GaSb, InAs, InP, InSb and SiC) were investigated. The samples (Ge, Si, Ge-Si) were deposited by radio frequency (RF) sputtering onto either water or liquid nitrogen-cooled substrates (glass, optically polished quartz, alkali halides, sapphire, and copper). Some films were obtained by evaporation. The noncrystallinity of the films was determined by X-ray diffraction. The effects of the experimental parameters (deposition rate, substrate temperature, deposition process) on various properties were investigated. Dissert. Abstr.

N75-32916 American Univ., Washington, D.C.
THERMOELECTROSTATIC EFFECTS IN SUPERCONDUCTORS Ph.D. Thesis
Nancy K. Welker 1975 136 p
Avail: Univ. Microfilms Order No. 75-20515

An investigation was made of the possible existence of a thermoelectrostatic effect in superconductors, which is predicted on the basis of the two-fluid London model of superconductivity and an analogy with superfluid helium. The phenomenon of Josephson tunneling is used as a means of detecting such an effect since any thermally generated supercurrent should produce a shift in the critical current of a Josephson point contact. Niobium was chosen as the sample because of its good mechanical properties and high predicted thermopower. Samples were prepared at ultrahigh vacuum and 4.2 K to prevent surface contamination. Contrary to the results of two previous experiments, these measurements show that, within the limitations of the data collection system, no thermoelectrostatic effect exists in Nb which implies that no such effect exists in any superconductor. Dissert. Abstr.

N75-32917 Boston Univ., Mass.
ULTRASONIC HEATING OF THE SPINS IN bcc SOLID He-3 Ph.D. Thesis
Frank Edgar Kearly 1975 136 p
Avail: Univ. Microfilms Order No. 75-20995

Sound generated by a quartz piezoelectric crystal was observed, with nuclear magnetic resonance, to heat the Zeeman system in solid He(3) above the temperature of the phonons. This heating was studied in samples of two purities, 2600 ppm He(4) (sample A) and 350 ppm He(4) (sample B). The temperature range was between .1K and .2K, where both samples were in the diffusion dominated plateau region of thermal relaxations. Dissert. Abstr.

N75-32918 University of Southern Calif., Los Angeles.
ELECTRICAL CHARACTERIZATION OF DEEP LEVEL IMPURITIES IN SEMICONDUCTOR JUNCTIONS: SCHOTTKY BARRIERS OF HAFNIUM ON INDIUM DOPED p-TYPE SILICON Ph.D. Thesis
Moiz Mulla Enayatali Beguwala 1975 273 p
Avail: Univ. Microfilms Order No. 75-19002

The effect was studied of deep level impurities on admittance of semiconductor junction devices, such as p-n junctions, Schottky barrier diodes, and MOS structures. Guidelines were developed for theoretical modeling and presentation of experimental data to optimize the determination of the properties: the impurity species ground state energy level, concentration, and majority carrier capture cross-section. The deep level contributions to admittance of a junction device are derived in a differential equation form. The solution to the differential equation can be modeled by lumped frequency independent elements over a wide frequency and bias range if the deep impurities are virtually un-ionized in the bulk semiconductor and all the impurities have a uniform spatial distribution. All but one of the elements are also bias independent. The circuit elements of the lumped model bear simple direct relationships to the deep level parameters. The procedure for synthesizing an equivalent circuit from admittance vs. frequency, bias, and temperature measurements is shown. Dissert. Abstr.

N75-32919 California Inst. of Tech., Pasadena.
SUPERCONDUCTIVITY IN METAL-SEMICONDUCTOR EUTECTIC ALLOYS Ph.D. Thesis
William Lewis Johnson 1975 99 p
Avail: Univ. Microfilms Order No. 75-19997

The superconductivity of several metal-semiconductor simple eutectic alloys containing Ge or Si, and one of the metals Al, Be, In, Pb, Sn, or Tl was investigated. The liquid-quenching technique was used to reduce the characteristic scale of the microstructure in the alloys. It was found in some cases (notably Al-base alloys) that the superconducting transition temperature of the metallic phase was significantly enhanced as a result of liquid-quenching. The characteristic scale of the microstructure was found to be of the order of several hundred angstroms in alloys showing the greatest enhancement effect. The results are discussed in terms of recent theoretical models that predict enhancement of superconductivity due to electronic interactions at a metal-semiconductor interface. The results are also analyzed in terms of the McMillan theory of superconductivity in which the enhancement effect is attributed to a reduction in the characteristic phonon frequencies of the metal. Dissert. Abstr.

N75-32920 Princeton Univ., N.J.
ON THE ROLES OF CONVECTIVE AND DIFFUSIVE PROCESSES IN THE ELECTROHYDRODYNAMICS OF SMALL PARTICLES AND SUSPENSIONS Ph.D. Thesis
Robert Bruce Spertell 1974 224 p
Avail: Univ. Microfilms Order No. 75-20664

A number of phenomena related to the coupling between fluid motions and electrical effects were investigated, such as: deformation of ionic double-layers due to flow and external fields, shape and translation of small particles, and the rheology and conductivity of suspensions. Deformation of a thin ionic double-layer around a fluid or solid sphere suspended in a uniform flow was examined for both high and low Peclet numbers. The convection-diffusion mechanism is found to give rise to a long-range electrical potential which influences the motion of a fluid sphere caused by an electrical field. Motions initiated by an external electrical field, as well as those owing to translation of a fluid sphere, can contribute to charge convection. The relation between stress and strain-rate in a dilute suspension with either a monolayer or double-layer on each of their interfaces may be described by an apparent viscosity. Dissert. Abstr.

N75-32921 Ohio State Univ., Columbus.
SURFACE POTENTIALS OF SENSITIZATION AND THE MECHANISMS OF SPECTRAL SENSITIZATION Ph.D. Thesis
Garth Bowen Freeman 1974 90 p
Avail: Univ. Microfilms Order No. 75-19437

Surface potentials were measured for cationic, anionic, and nonionic dye sensitizers, and for some desensitizers, adsorbed on cadmium sulfide, silver chloride and silver bromide. It is found that all dye surfaces examined in the dark are positively charged with respect to cadmium sulfide as are all good sensitizers adsorbed on the silver halides. Desensitizers are either less positive or absolutely negative with respect to the substrate surface. The contribution of dipole effects in cationic sensitizers was evaluated and found to be entirely insufficient to account for the observed effects. The system was also examined under irradiation by various spectral regions. The effects of the adsorbed dyes were isolated by irradiating the cadmium sulfide systems with orange light of wave length greater than 580 nm. The dye surfaces become positive reversibly under irradiation, demonstrating the existence of electron transfer. Dissert. Abstr.

N75-32922 Ohio State Univ., Columbus.
A KINEMATIC APPROACH TO THE THEORY OF NUCLEAR MAGNETIC RESONANCE AND RELAXATION IN LIQUIDS AND SOLIDS WITH APPLICATIONS Ph.D. Thesis
Bob Leroy Weber 1975 183 p
Avail: Univ. Microfilms Order No. 75-19500

A kinematic approach is used to derive analytical equations that describe nuclear magnetic resonance (NMR) in liquids and solids. The derivation begins with Schroedinger's equation for the spin-lattice system and the second law of thermodynamics, which reveals the irreversibility of the equations of motion. The analytical equations for liquids look very much like Bloch's equations with general longitudinal and transverse spin-lattice relaxation terms. Meanwhile, the equations for solids are similar to Provotorov's equations and Redfield's equations. However, the derivation of the equations for solids does not use the spin temperature or the partition function for the density matrix. It is shown that the density matrix can always be expanded in terms of an appropriate set of quantum mechanical operators. Also, the equations for solids are applicable at all levels of the RF field, while Provotorov's equations are valid only for RF fields much smaller than the intrinsic line width and Redfield's equations are valid only for RF fields much greater than this line width. Dissert. Abstr.

N75-32923 University of Southern Calif., Los Angeles.
LOW FREQUENCY RAMAN SCATTERING FROM SIMPLE LIQUIDS Ph.D. Thesis

William Paul Proffitt 1975 86 p
Avail: Univ. Microfilms Order No. 75-19031

The shape of the Rayleigh wings of six liquids has been studied in detail. The anisotropic molecule liquids have central portions Lorentzian lineshapes in agreement with rotational relaxation theory and previous measurements. Beyond the central portion, the wings are exponential. The symmetric molecule liquids also have exponential wings in agreement with recent calculations on collision-induced light scattering. A qualitative model for the intensity of dimer spectra vs. collision induced spectra fits the results for Argon, Krypton, and Xenon. A method for taking the depolarization ratio as a function of frequency, utilizing electro-optic polarization switching, is described. The possibilities for automatic computation to the accuracy of the spectrometer system are outlined. A synopsis of the techniques utilized for extra rejection of the elastically scattered light in Raman scattering experiments is given. A technique for obtaining at least a 500 improvement in rejection of elastically scattered light is reported. Dissert. Abstr.

N75-32924 Princeton Univ., N.J.
INVESTIGATION OF PROPERTIES OF METAL-INSULATOR-SEMICONDUCTOR AND METAL-NITRIDE-OXIDE-SILICON STRUCTURES Ph.D. Thesis
Neil Philip Gordon 1974 214 p
Avail: Univ. Microfilms Order No. 75-20633

The switching mechanism in thin oxide metal-nitride-oxide-silicon (MNOS) devices, and the problem of the effects produced by minority carriers on the ac and transient response of both uniform and laterally nonuniform MIS structures were investigated. The results of pulsed switching experiments and the dc current-voltage characteristics of thin-oxide MNOS devices indicate that the dominant switching mechanism is the result of tunneling of electrons (holes) from the silicon conduction (valence) band into the nitride conduction (valence) band with subsequent trapping in the nitride. In studying the response of the MIS capacitor to step excitation, it was found that the frequency characterizing the decay of the transient current depends on the sign of the step. A steady-state analysis, using a square wave for mathematical convenience, shows that the lateral transfer of minority carriers across the edge of an abrupt lateral nonuniformity substantially increases the generation of carriers from interface traps during one-half of the cycle and increases the area under the MIS conductance-voltage characteristic. Dissert. Abstr.

N75-32925 University of Southern Calif., Los Angeles.
ACOUSTIC TEMPERATURE DETECTION: APPLICATION TO INFRARED ABSORPTION PROCESSES Ph.D. Thesis
Theodor Sebastian Colbert 1975 96 p
Avail: Univ. Microfilms Order No. 75-19007

A measurement technique was developed which uses acoustic surface waves as a probe of the interaction between infrared radiation and an absorbing material. It is shown that the heat deposited in the material during the interaction alters the phase of the surface wave propagating through the heated region. This phase change is related theoretically to the parameters of the interaction, that is of the laser beam and the absorbing substrate. The effect was measured experimentally for various materials, and the results are compared with the theory. A method was developed to couple acoustic surface waves to nonpiezoelectric materials through a fluid interface between piezoelectric and nonpiezoelectric surfaces. These techniques were applied to the measurement of weak surface radiative absorption of alkali halide crystals at 10.6 microns and initial results are included. Dissert. Abstr.

N75-32926 Case Western Reserve Univ., Cleveland, Ohio.
MICROWAVE STUDIES OF SUPERCONDUCTING MICRO-BRIDGES Ph.D. Thesis
Frederic Joseph Rachford 1975 274 p
Avail: Univ. Microfilms Order No. 75-19238

The properties of thin film superconducting rings containing microbridge sections were studied at 9.24 GHz. The microbridge geometries studied include rectangular constrictions, zero length butterfly Dayem microbridges, and proximity effect weak-links. The thin films were made by evaporating tin, lead, or lead - 40% thallium alloy on rotating 1 millimeter quartz rods in which the constrictions later were fabricated. Many complex effects were noted in the microwave response of these inductively coupled samples, and are discussed. Dissert. Abstr.

N75-32927*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARGE EXCHANGE IN ZINC-NEON
Donald L. Chubb 1975 20 p refs Presented at the Twenty-eighth Ann. Gaseous Electronics Conf., Rolla, Mo., 21-24 Oct. 1975; sponsored by the Am. Phys. Soc.
(NASA-TM-X-71801; E-8481) Avail: NTIS HC $3.25 CSCL 20L

Excitation of the 4d and 5p levels of Zn+ by charge exchange bewteen Ne+ and Zn was investigated. From measured electron temperature and line intensity ratios it was concluded that charge exchange is the dominate mechanism for populating the 4d2D5/2 level of Zn+. Comparison of Zn-Ne and Zn-Ar results imply the same conclusion. No evidence for charge exchange as the dominant pumping mechanism for the 5p2PI/2, 5p2P3/2, or 4d2D3/2 levels was obtained. Author

N75-32928*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF CRYSTALLIZATION Patent Application
Hans U. Walter (Ala. Univ., Huntsville) and Robert S. Snyder, inventors (to NASA) Filed 5 Sep. 1975 10 p
(NASA-Case-MFS-23001-1; US-Patent-Appl-SN-610801) Avail: NTIS HC $3.25 CSCL 20L

A method of growing or refining bulk singles crystals, particularly crystals of semiconductor materials useful in the manufacture of solid state electronic components, is reported. A principle difficulty in the crystallization of such materials is that of obtaining crystals of a desired maximum size. The procedure described solves this problem by growing crystals in a base material that is suspended, positioned, and shaped as a containerless melt by wetting forces in an environment substantially free of gravity. NASA

N75-32929# National Bureau of Standards, Washington, D.C.
NUCLEAR MAGNETIC RESONANCE, NO. 3
P. M. Borodin 1975 165 p refs Transl. into ENGLISH from Mono. Yadernyi Magnitn. Rezonans (Leningrad), v. 3, 1969 Sponsored in part by NSF
(TT-73-52031) Avail: NTIS HC $6.25 CSCL 20L

The book contains a number of articles concerning nuclear magnetic resonance. Theory, experimental results, structure and molecular dynamics of liquids and solids, apparatus, and EPR in a weak magnetic field are topics discussed. GRA

N75-32930# Army Foreign Science and Technology Center, Charlottesville, Va.
SUPERCONDUCTING COMPOUNDS OF METALS AND THEIR USES
E. M. Savitskii and Yu. V. Efimov 12 Apr. 1974 16 p refs Transl. into ENGLISH from Mono. Metalloved. (USSR), 1971 p 408-414
(AD-A009350; FSTC-HT-23-127-74) Avail: NTIS CSCL 11/6

Semiempirical and empirical relationships between the physicochemical parameters of the class of metal compounds, otherwise referred to as intermetallides, and their superconducting transition temperatures are analyzed. Relationships are sought between degree of metallic bonding in their lattices, crystal structure types, and phase changes -- and their superconducting transition temperatures. GRA

N75-32931# California Univ., San Diego. Dept. of Physics.
NON-LOCAL CORRECTIONS TO THE ELECTRONIC STRUCTURE OF METAL SURFACES
King-Hon Lau and Walter Kohn Apr. 1975 24 p refs Sponsored in part by NSF
(Contract N00014-69-A-0200-6026; NR Proj. 017-653)
(AD-A010189; TR-30) Avail: NTIS CSCL 20/12

A non-local exchange-correlation term, derived from the static dielectric function of Vashishta and Singwi (VS), is introduced into the density functional for an interacting electron gas. The coefficient is chosen to give the same surface energy for two adjacent jellium metals of nearly equal density as is obtained from the VS dielectric function. This density functional is then

used to calculate surface energies and work functions for metal-vacuum interfaces. The results for both surface energies and work functions found in this way are significantly higher than the experimental values. Possible explanations for the discrepancies are discussed. GRA

N75-32932# California Univ., San Diego. Dept. of Physics.
A RECURSION METHOD FOR SELF-CONSISTENT CALCULATIONS IN METALS
John J. Rehr and C. C. Pei Mar. 1975 16 p refs
(Contract N00014-69-A-0200-6026; NR Proj. 017-653)
(AD-A010188; TR-29) Avail: NTIS CSCL 20/12

The authors show how the recursion method of Haydock et al. may be generalized to permit the point by point calculation of the local electronic density of states in a metal. Coupled with the density functional formalism, this technique provides a way of self-consistently calculating electronic structure in periodic and aperiodic materials, without the necessity of calculating the eigenfunctions. While similar to a method of Kohn based on moment techniques, our method differs in that moments per se are not required. The method is illustrated for the case of a half-filled, tight-binding band in a simple cubic crystal, in a subsequent paper. GRA

N75-32933# Colorado State Univ., Fort Collins. Dept. of Physics.
QUANTUM SIZE EFFECTS IN SEMIMETALS AND SEMICONDUCTORS Annual Summary Report, 1 Feb. 1974 - 31 Jan. 1975
James R. Sites 31 Jan. 1975 14 p refs
(Contract N00014-67-A-0299-0017; NR Proj. 372-305)
(AD-A006740; SF5) Avail: NTIS CSCL 20/12

Results have been obtained on the electrical transport properties near the surfaces of InAs and InSb thin films. Progress has been made in producing insulating oxide barriers on InSb single crystals and thin films. There has been a continuing development of the facilities for fabricating and studying compound semiconductors. GRA

N75-32934# Spectronics, Inc., Richardson, Tex.
FIBER OPTIC LED Final Technical Report
R. S. Speer Mar. 1975 57 p refs
(Contract N00123-74-C-2024)
(AD-A010356) Avail: NTIS CSCL 09/1

This report deals with the electrical, optical and mechanical characteristics of a fiber optic GaAlAs LED developed for the US Navy, Naval Electronics Laboratory Center, San Diego, California. The developed LED is optimized for coupling to 45 mil diameter conventional multimode fiber bundles. Coupling efficiencies to commercial fiber bundles are calculated and compared to experimental results. Life test results on these new LEDs are also presented. GRA

N75-32935# New South Wales Univ., Kensington (Australia). School of Physics.
ELECTRON PARAMAGNETIC RESONANCE STUDY OF GaAs SURFACES Annual Report, 1 Feb. 1974 - 31 Jan. 1975
D. Haneman 16 May 1975 35 p refs
(Grant DA-CRD-AFE-S92-544-71-G168; DA Proj. 1Z6-24201-D-466)
(AD-A010407; ARDG(FE)-440-9; AR-10; ARDG(FE)-440-10) Avail: NTIS CSCL 20/12

EPR investigations of GaAs (and other) semiconductor surfaces in this laboratory have yielded unique information about surface wave functions and surface charged sites. This basic information is required for understanding GaAs surfaces covered with cesium and oxygen which are of technological importance in night vision and other devices. To obtain sufficient EPR signal the large surfaces of powders were studied, obtained by crushing in ultra high vacuum. However more detailed information is obtainable from oriented cleaved single crystal surfaces and rather elaborate experimental arrangements have been constructed to obtain such data. The results for GaAs show that the single crystal surface signals are much lower than expected. Because of the large and easier to measure signals from silicon, studies were focussed on this material. GRA

N75-32936# Air Force Weapons Lab., Kirtland AFB, N.Mex.
USE OF HIGH ENERGY, SHORT PULSE EXPLOSIVE GENERATORS TO DRIVE ELECTROMAGNETIC IMPLOSIONS Final Report, Jul. 1971 - Sep. 1973
Peter J. Turchi and Robert S. Caird Apr. 1975 61 p refs
(AD-A010046; AFWL-TR-74-222) Avail: NTIS CSCL 20/9

The feasibility of using high energy (about 5 MJ), short pulse time (about 2 microseconds) explosive generators to drive electromagnetic implosions is investigated theoretically. Detailed calculations show that the generated energy can be transferred to imploding plasma discharges with efficiencies exceeding 50 percent. The creation of multimegajoule plasmas is possible using moderate amounts of high explosive (about 25 kg). By employing more generators, plasma implosion speeds in excess of 100 cm/microseconds and kinetic energies exceeding 10 MJ are computed. Such plasmas can be used to compress other plasmas and/or magnetic fields or to produce high power prompt radiation at levels in excess of 10 to the 14th power W. Practical factors limiting generator performance are considered in detail. Specific areas of concern include resistive heating, internal arcing, and conductor dynamics. Two types of generator designs are investigated, both based on plane detonation systems. One design is a parallel plate generator and the other a new coaxial configuration. Relative advantages and disadvantages are discussed and some initial experimental work related to the new design is presented. GRA

N75-32937# General Electric Co., Schenectady, N.Y.
INTRINSIC DEFECTS IN 2-6 COMPOUNDS Final Report, 15 Mar. 1972 - 30 Jun. 1974
George D. Watkins Mar. 1975 86 p refs
(Contract F33615-72-C-1505; AF Proj. 7885)
(AD-A010105; SRD-74-131; ARL-75-0011) Avail: NTIS CSCL 20/12

Electron paramagnetic resonance (EPR) and optical studies have been used to study zinc vacancies and associated defects both in as-grown material and as produced by 1.5 MeV electron irradiation in cubic ZnSe and ZnS. Extensive studies of room temperature defect production and subsequent anneal vs sample preparation and history were performed in ZnSe. Defects observed and studied include the isolated zinc vacancy and zinc vacancies trapped by substitutional sulfur, tellurium, and chlorine impurities. Defects studied in ZnS include the isolated zinc vacancy and the zinc-vacancy-chlorine donor pair. Irradiation at 20.4 degrees K revealed several spectra in ZnSe, which were identified as zinc vacancy-zinc interstitial close-pairs of different microscopic configuration. Extensive studies using uniaxial stress and unidirectional electron beams which allow detailed microscopic models to be proposed for these defects were performed. This represents the first direct unambiguous observation of close Frenkel pairs in any solid. GRA

N75-32938# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
ANALYSIS OF SEMICONDUCTOR STRUCTURES BY NUCLEAR AND ELECTRICAL TECHNIQUES, SILICIDE FORMATION Interim Report
Wei-Kan Chu, Sylvanus S. Lau, James W. Mayer, and Marc A. Nicolet 31 Jan. 1975 88 p refs
(Contract F19628-75-C-0008)
(AD-A010041; SR-1; AFCRL-TR-75-0092) Avail: NTIS CSCL 20/12

The report presents three studies of silicide formation in systems composed of single crystal silicon overlaid with a metal film. Common to all this work is the use of MeV He ion backscattering and glancing angle X-ray diffraction as the principal analytical tools. Backscattering data gives composition as a function of depth and hence can be used to determine growth kinetics while X-ray diffraction gives identification of phases and structural information. Work is reported in the following areas: Implanted noble gas atoms as diffusion markers in silicide formation; Structure and growth kinetics of Ni2Si on silicon; Iron silicide thin film formation at low temperatures. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N75-32939 Denver Univ., Colo.
ENHANCEMENT OF RATES OF FREEZING AND MELTING IN THE PROGRAMMED INDIRECT FREEZING PROCESS
Ph.D. Thesis
Thomas John Ford 1975 183 p
Avail: Univ. Microfilms Order No. 75-18716

A cloud seeding technique for the programmed indirect freezing process has been developed that produces ice crystals suspended in the bulk air phase and nucleates a supercooled liquid film thus forming an ice film inside the freezer-melter unit. Part of the brine fed at its freezing temperature is frozen and fresh water is used to displace the concentrated brine from the center of the tube. Oscillatory flow is used to improve the washing efficiency by making the ice-brine interface more planar. This technique increases productivity by saving a substantial amount of wash water. The product made from 3000 ppm brackish water has been purified to under 500 ppm under controlled conditions. A mathematical model was formulated to determine if the rate of mass transfer of a dissolving wall is enhanced by laminar oscillatory flow, and to predict the freezing rate in the freezer-melter unit. Dissert. Abstr.

N75-32940 Ohio State Univ., Columbus.
MAXIMUM ENTROPY PRINCIPLE AND ITS APPLICATIONS TO SPECTRAL ANALYSIS AND IMAGE RECONSTRUCTION
Ph.D. Thesis
Ming-tung Hsu 1975 152 p
Avail: NTIS Avail: Univ. Microfilms Order No. 75-19452

A theoretical investigation was made of the maximum entropy method (MEM) and its applications to the spectral analysis and the image reconstruction. The entropy representations in time and frequency domains respectively were derived and the theoretical structure of the MEM is discussed. It is found that the MEM is equivalent to the autoregressive method and the maximum likelihood method. The theory of the MEM was extended to obtain a two-dimensional solution for image reconstruction. In the image reconstruction, one must deal with a complex Gaussian process, instead of a real Gaussian process as in the case of spectral analysis. Hence a complex Gaussian distribution and its entropy are derived. The MEM formula for the two-dimensional case was also developed. Dissert. Abstr.

N75-32941*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
INPUT GUIDE FOR COMPUTER PROGRAMS TO GENERATE THERMODYNAMIC DATA FOR AIR AND FREON CF4
James A. Tevepaugh, Morris M. Penny, and L. Ray Baker Mar. 1975 59 p refs
(Contract NAS9-13429)
(NASA-CR-144431; LMSC-HREC-TM-D390169) Avail: NTIS HC $4.25 CSCL 20M

FORTRAN computer programs were developed to calculate the thermodynamic properties of Freon 14 and air for isentropic expansion from given plenum conditions. Thermodynamic properties for air are calculated with equations derived from the Beattie-Bridgeman nonstandard equation of state and, for Freon 14, with equations derived from the Redlich-Quang nonstandard equation of state. These two gases are used in scale model testing of model rocket nozzle flow fields which requires simulation of the prototype plume shape with a cold flow test approach. Utility of the computer programs for use in analytical prediction of flow fields is enhanced by arranging card or tape output of the data in a format compatible with a method-of-characteristics computer program. Author

N75-32942*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DEVELOPMENT OF THERMAL STRATIFICATION AND DESTRATIFICATION SCALING CONCEPTS. VOLUME 1: DEFINITION OF THERMAL STRATIFICATION SCALING PARAMETERS AND EXPERIMENTAL INVESTIGATIONS
Final Report, 27 Jun. 1969 - 16 Jul. 1973
T. M. Lovrich and S. H. Schwartz Oct. 1975 184 p refs
(Contract NAS8-24747)
(NASA-CR-143944) Avail: NTIS HC $7.00 CSCL 20M

The dimensionless parameters associated with the thermal stratification and pressure history of a heated container of liquid and its vapor were examined. The Modified Grashof number, the Fourier number, and an Interface number were parameterized using a single test liquid, Freon 113. Cylindrical test tanks with spherical dome end caps were built. Blanket heaters covered the tanks and thermocouples monitored the temperatures of the liquid, the ullage, the tank walls, and the foam insulation encapsulating the tank. A centrifuge was used for the 6 inch tank to preserve the same scaling parameter values between it and the larger tanks. Tests were conducted over a range of Gr* values and the degree of scaling was checked by comparing the dimensionless pressures and temperatures for each scaled pair of tests. Results indicate that the bulk liquid temperature, the surface temperature of the liquid, and the tank pressure can be scaled with the three dimensionless parameters. Some deviation was, however, found in the detailed temperature profiles between the scaled pairs of tests. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N75-32943*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE 1975 NASA/ASEE SUMMER FACULTY FELLOWSHIP RESEARCH PROGRAM Final Administrative Report
Sep. 1975 65 p refs Prepared jointly with Ala. Univ. and Auburn Univ.
(Grant NGT-01-002-080)
(NASA-TM-X-72500; BER-199-94) Avail: NTIS HC $4.25 CSCL 05I

A research program was conducted to further the professional knowledge of qualified engineering and science faculty members, to stimulate an exchange of ideas between participants and NASA engineers and scientists, and to enrich the research activities of the participants' institutions. Abstracts of reports submitted at the end of the program are presented. Topics investigated include multispectral photography, logic circuits, gravitation theories, information systems, fracture mechanics, holographic interferometry, surface acoustic wave technology, ion beams in the upper atmosphere, and hybrid microcircuits. M.J.S.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N75-32944# Army Foreign Science and Technology Center, Charlottesville, Va.
CERTAIN ORGANIZATIONAL PROBLEMS IN THE MANAGEMENT OF RESEARCH AND DEVELOPMENT PROJECTS IN AN INDUSTRY SCIENTIFIC RESEARCH INSTITUTE
B. I. Gofman 27 Aug. 1974 12 p refs Transl. into ENGLISH from Naukoved. i Informatika Resp. Mezhved. Sb. (USSR), issue 5, 1972 p 86-89
(AD-A000998; FSTC-HT-23-0218-74) Avail: NTIS CSCL 05/1

The author discusses the use of standard network model in the planning of scientific research projects, experimental design projects and other research and development work in the semiconductor industry. The incorporation of standards network models in serial production planning reduced the duration of the development-production cycle by 30%, shortened production deadlines and also contributed to substantial savings in manpower and time. GRA

N75-32945# Illinois Univ., Urbana.
A MULTI-FACETED COMPUTER-BASED COURSE MANAGEMENT SYSTEM Subproject Report, 1 Jan. - 1 Nov. 1974
T. H. Anderson, B. R. Dalgaard, D. W. Paden, J. R. Surber, and H. R. Smock Apr. 1975 20 p refs
(Contract N61339-73-C-0078)
(AD-A010120; NPRDC-TR-75-30) Avail: NTIS CSCL 05/9

The Course-Management System was designed to integrate books, computers and live teachers in an effective manner for courses with large numbers of students and instructors. The logistic problems associated with multifaceted instructional programs were solved, in part, by using PLATO--a computer-assisted instruction system centered at the University of Illinois. Students in the computer-managed course acquire basic information and concepts from individual reading. Their attention to the material is maintained and their progress monitored by a previously developed Computer-Assisted Instruction Study-Management System. Lectures and standard quiz sections are little used. The time of instructors is invested in remediation for students having trouble mastering the core curriculum and in teaching seminars. The role of the computer is to manage study behavior, administer on-line achievement tests, and schedule group tutorial and seminar sessions. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N75-32946 Florida Univ., Gainesville.
ANALYSIS OF DATA WITH MULTIPLE OUTLINERS Ph.D. Thesis
Ronald George Marks 1974 92 p
Avail: Univ. Microfilms Order No. 75-19357

During the course of data collection, and when the objective is to estimate the mean of a normal population, not all the data may be from a homogeneous source. A modification of some existing rules is presented by taking into account that, it is very unlikely that, at most, one spurious observation will appear in the sample. The suggested modification was appropriate under the assumption that the number of spurious observations in a sample is a random variable having a binomial distribution. The idea that the sample variance should provide some valuable information concerning any spurious observations in the sample was treated. Rules which use the sample variance to determine whether spurious observations are presented were developed. A Monte Carlo study was used to compare all the rules discussed. The results of the Monte Carlo study show that the assumption that the number of spurious observations in a random variable causes virtually no change in the resulting computed values. Dissert. Abstr.

N75-32947 Ohio State Univ., Columbus.
A MODEL FOR DATA SECURE SYSTEMS Ph.D. Thesis
Edwin John McCauley, III 1975 255 p
Avail: Univ. Microfilms Order No. 75-19469

A multi-level modeling technique is developed to examine protection and access control in data base management systems. This approach allows the treatment of specific issues at a level of abstraction appropriate to that issue. The technique is comprised of: (1) the conceptual model which describes the terms and concepts of protection; (2) the structural model which emphasizes relations between records and uses these relations to provide and enhance security; (3) the engineering model which relates the theoretical results of the higher levels to the practical realities of typical data base management systems. In the lowest level the correctness and completeness of a small demonstration system are discussed. The correctness techniques are viewed as a sketch of a formal algorithm proof. Dissert. Abstr.

N75-32948*# IBM Federal Systems Div., Huntsville, Ala. Electronics Systems Center.
SPACELAB USER INTERACTION STUDY. PHASE 2: REVIEW
May 1975 88 p
(Contract NAS8-31167)
(NASA-CR-143953; IBM-75W-00093) Avail: NTIS HC $4.75 CSCL 05B

Data management for the Spacelab Program is considered with particular attention to the human role in the process. D.M.L.

N75-32949*# Battelle Columbus Labs., Ohio.
A DESIGN STUDY OF A PHOTOREFRACTIVE PAGE COMPOSER Final Report, 1 Jan. - 15 Sep. 1975
15 Sep. 1975 38 p refs
(Contract NAS8-31291)
(NASA-CR-143949) Avail: NTIS HC $3.75 CSCL 05B

A laboratory demonstration and preliminary system analysis of a page composer designed to have the dual advantages of low optical loss and small size, were reported. The current page composer is optically addressed and functions by virtue of optically induced refractive index changes in the active material. Laboratory demonstrations of the device were successfully performed using 10 x 10 bit and 128 x 128 bit data arrays. It was established that the only significant obstacle to the construction of a brass-board model working at megabit data rates is the lack of sensitivity of the photorefractive materials which were considered during the course of this study. Possible materials for future consideration are the photoplastics. While they have more than the required sensitivity, their stability and suitability for double exposure holography was not investigated. If a sufficiently sensitive material is found, then the photorefractive page composer could be built to perform in a highly efficient fashion which would result in a overall reduction of the size of the memory system and an easing of the requirements upon the sensitivity of the holographic recording material. Author

N75-32950*# IBM Federal Systems Div., Huntsville, Ala.
SPACELAB USER INTERACTION Final Report
31 Aug. 1975 107 p
(Contract NAS8-31167)
(NASA-CR-143954; IBM-75W-00172) Avail: NTIS HC $5.25 CSCL 05B

The results of the third and final phase of a study undertaken to define means of optimizing the Spacelab experiment data system by interactively manipulating the flow of data were presented. A number of payload applicable interactive techniques and an integrated interaction system for each of two possible payloads are described. These interaction systems have been functionally defined and are accompanied with block diagrams, hardware specifications, software sizing and speed requirements, operational procedures and cost/benefits analysis data for both onboard and ground based system elements. It is shown that accrued benefits are attributable to a reduction in data processing costs obtained by, generally, a considerable reduction in the quantity of data that might otherwise be generated without interaction. One other additional anticipated benefit includes the increased scientific value obtained by the quicker return of all useful data. Y.J.A.

N75-32951*# IBM Federal Systems Div., Huntsville, Ala.
SPACE STATION DATA FLOW, AMENDED
May 1974 60 p
(Contract NAS8-31167)
(NASA-CR-143952; IBM-74W-00140) Avail: NTIS HC $4.25 CSCL 05B

A study was conducted to define an interactive user interface and to present interaction implementation concepts. The interactive systems addressed are differentiated according to onboard versus ground-based; interactions from a spacelab viewpoint were studied from the standpoint of real-time versus non-real-time. Consideration is given to data forms and rated to determine where man-tended experiment processing can improve the cost/performance relationships for spacelab. Author

N75-32952# Army Construction Engineering Research Lab., Champaign, Ill.

DEVELOPMENT OF THE ENVIRONMENTAL TECHNICAL INFORMATION SYSTEM
R. D. Webster, R. L. Welsh, and R. K. Jain Apr. 1975 68 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A009668; CERL-IR-E-52) Avail: NTIS CSCL 05/2

The report presents the research to date on the development and refinement of two computer-aided technical information systems that the Army can use in environmental assessments. The Computerized Environmental Legislative Data System (CELDS) catalogues abstracts of environmental laws and statutes by geographic scope and keyword designation. CELDS includes quantifiable and objective standards and report or permit requirements of all active laws or regulations that may concern the Army. CELDS is complete for six states and for areas of federal jurisdiction, and data for another ten states are currently being collected and analyzed. The system will eventually include all 50 states. The Economic Impact Forecast System (EIFS) uses census bureau information on over 360 counties to calculate environmental impacts for construction on 64 Army installations. EIFS predicts how the expenditure of federal construction dollars will affect local businesses, households, and governments in the areas of employment, personal income, total business volume, housing revenues, housing and business investments, and government expenses. EIFS uses export-based location quotient techniques as the basis for its predictions. The system will be expanded in the future to cover areas other than construction and to include additional regions. GRA

N75-32953# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF A MODIFIED AIDS TO NAVIGATION MANAGEMENT INFORMATION SYSTEM FOR THE UNITED STATES COAST GUARD WITH AN ILLUSTRATED APPLICATION THROUGH COST EFFECTIVENESS AND MALFUNCTION ANALYSES M.S. Thesis
Robert Marshall Stephan, Jr. Mar. 1975 294 p refs
(AD-A009934) Avail: NTIS CSCL 17/7

The purpose of this project is to identify, examine, and evaluate certain cost-effectiveness relationships of the Short Range Aids to Navigation (SRAN) Sub-System developed by the United States Coast Guard. It was determined that a need exists to modify the present Aids to Navigation Management Information System. In addition to providing information, this report provides a legal and historical record of the navaid. A modified management information system is presented and its application is illustrated through selected cost-effectiveness analyses. GRA

N75-32954# National Bureau of Standards, Washington, D.C.
JOURNAL OF RESEARCH OF THE NATIONAL BUREAU OF STANDARDS: A, PHYSICS AND CHEMISTRY, VOLUME 79A, NUMBER 2, MARCH - APRIL 1975
1975 72 p refs
(COM-75-50214-02; JNBAAR-79A(2); LC-62-37059) Avail: NTIS MF $2.25; SOD HC as C13.22/secA:79/2 CSCL 07D

Articles are presented which emphasize physical measurement, fundamental constants, and properties of matter. Specific topics discussed include: thermal conductivity of gases; differential cross section for X-ray inelastic scattering; simplification of van der Poel's formula for the shear modulus of a particulate composite; enthalpies of combustion and formation of nicotinic and creatinine; simultaneous measurements of specific heat, electrical resistivity, and hemispherical total emittance by a pulse heating techniques; and heat capacities of polyethylene. GRA

N75-32955# National Science Foundation, Washington, D.C. Office of Science Information Service.
FEDERAL SCIENTIFIC AND TECHNICAL COMMUNICATION ACTIVITIES: 1974 PROGRESS REPORT Annual Report, Jan. - Dec. 1974
Jun. 1975 103 p
(PB-242318/4; NSF/SIS-75-1) Avail: NTIS HC $5.25 CSCL 05B

The report presents highlights of 1974 activities of over 50 Federal scientific and technical information programs in 13 major departments and independent agencies, the Smithsonian Science Information Exchange, the Government Printing Office and the Library of Congress. Each program prepared its own description. The resulting descriptions, a list of acronyms and abbreviations, and an index are presented. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N75-32956# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
COST EFFECTIVENESS ANALYSIS OF COMPLEX REPAIR PROCESSES USING GRAPHICAL EVALUATION REVIEW TECHNIQUE (GERT)
Alfred Iwersen, Jr. Feb. 1975 39 p refs
(AD-A009477; AU-AFIT-SL-2-75) Avail: NTIS CSCL 15/5

This paper presents an approach to analyzing the costs attributable to sources of errors in complex multi-level repair processes which have many feedback loops and branching points. It is shown how computer simulation of such processes can be useful in identifying those general areas or subprocesses, which would, if improved slightly, result in major improvements in cost effectiveness. A hypothetical repair process is presented in the paper and is used to demonstrate a method of analyzing the costs associated with errors that are committed in the hypothetical process. The computer simulation technique which is used is called Graphical Evaluation Review Technique (GERT), which has been developed by A. A. B. Pritsker. The technique offers the basic advantage exploiting a canned FORTRAN 4 simulation program called Q-GERTS. GRA

N75-32957# Logistics Management Inst., Washington, D.C.
LOGISTIC AND ECONOMIC FACTORS AFFECTING THE RECLAMATION AND RECYCLING OF WASTE MATERIAL AND BY-PRODUCTS. PROJECT 3: ASSIGNMENT OF RESPONSIBILITIES IN DoD ORGANIZATIONS
Frank M. Reynolds, Joseph R. Wilk, and Robert D. Kaiser Apr. 1975 54 p refs
(Contract ARPA SD-321)
(AD-A009339; LMI-74-12) Avail: NTIS CSCL 13/2

This report concerns the assignment of responsibilities for solid waste operations and management in the DoD. Although it is policy that resource recovery should be practiced through the DoD, no office in OSD has been directly charged with that specific responsibility. Similarly, specific responsibility for avoidance of waste has not been directly assigned to any office. It is concluded that organizational improvements alone are not sufficient to achieve widespread resource recovery efforts throughout the DoD. Specific objectives and a plan for implementation of a resource recovery program are essential prerequisites. The report offers an approach to a plan. GRA

N75-32958# California Univ., Berkeley. Operations Research Center.
RAY-HOMOTHETIC PRODUCTION FUNCTIONS
Rolf Fare (Lund Univ.) and Ronald W. Shephard Mar. 1975 26 p refs
(Contract N00014-69-A-0200-1010; Grant NSF MPS-74-21222; NR Proj. 047-033)
(AD-A010138; ORC-75-1) Avail: NTIS CSCL 05/3

A class of production correspondences defined as ray-homothetic is introduced to span the familiar homogeneous, homothetic, semi-homogeneous and quasi-homogeneous production structures. It is found that ray homothetic structures which are output mix (input mix) independent lead to a scaling law of common form with the more special structures spanned, and imply price independent expansion paths of linear structure. Also, if inputs and outputs are strongly disposable and the input and output sets L(u) and P(x) are convex, linear structured expansion paths imply input mix and output mix independent ray homothetic structures. GRA

N75-32959# Environmental Technology Assessment, Inc., Oak Brook, Ill.
COST EFFECTIVENESS OF TRANSPORTATION CONTROL STRATEGIES FOR CARBON MONOXIDE Final Report

Jay E. Norco, Roger K. Raufer, and Kevin G. Croke Oct. 1974 124 p refs
(PB-241583/4; IIEQ-74-59) Avail: NTIS HC $5.25 CSCL 13B

The existing data and analyses are summarized related to the emission reduction effectiveness, costs, and feasibility of implementing several alternative strategies for reducing carbon monoxide in the Chicago central business district. An attempt was made to develop combinations of strategies designed to achieve the National Ambient Air Quality Standards for carbon monoxide based upon a proportional or rollback model using 1973 air quality data. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N75-32960# Comptroller General of the United States, Washington, D.C.
TECHNOLOGY TRANSFER AND INNOVATION CAN HELP CITIES IDENTIFY PROBLEMS AND SOLUTIONS Report to the Congress
6 Aug. 1975 65 p
(PSAD-75-110) Avail: NTIS; General Accounting Office Distribution Section P. O. Box 1020 Washington, D. C. 20013 HC $1.00 CSCL 05B

The California Four Cities Program designed to determine if aerospace technology could be used to help solve cities' problems is described with emphasis on program accomplishments and barriers to technology transfer. It is concluded that aerospace technology is a valuable tool in solving the various problems of cities, but social, political, and economic factors may prevent or delay applying technological solutions. J.M.S.

N75-32961# Department of Transportation, Washington, D.C. Office of Consumer Affairs.
THE VOICE OF THE TRANSPORTATION CONSUMER: A REPORT TO THE SECRETARY OF TRANSPORTATION ON NATIONWIDE CONSUMER PUBLIC HEARINGS CONDUCTED BY THE OFFICE OF CONSUMER AFFAIRS, 1971 - 1974 Final Report
Apr. 1975 665 p
(PB-241765/7; DOT/TES/OCA-75/2) Avail: NTIS HC $15.25; also available $19.00/set of 2 reports as PB-241778-SET CSCL 05A

The report includes an analysis of transportation concerns expressed by participants at 54 nationwide public hearings held from 1971-1974. Also included is a tabulation of responses to 1,280, 29-part questionnaires returned by hearing attendees. Subject areas include: balanced transportation; transportation planning; transportation funding; citizen participation in transportation planning; elderly and handicapped; energy; environment; rural transportation; technology; automobile; aviation; bicycles; bus; highways; motorcycles; pedestrians; rail; rapid transit; trucks, and water transportation. GRA

N75-32962# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
RESEARCH PRIORITIES ON TECHNOLOGY TRANSFER TO DEVELOPING COUNTRIES, VOLUME 1 Final Report
Albert H. Rubenstein, Theodore W. Schlie, and Alok K. Chakrabarti Jan. 1974 118 p refs
(Grant NSF GI-39239)
(PB-242314/3; NSF/RA/X-74-007-Vol-1) Avail: NTIS HC $5.25 CSCL 05A

The report contains the results of two NU/NSF workshops held at Northwestern University, May 1973, and Washington, D.C., September 1973, to identify important, researchable questions in the area of technology transfer to developing countries, and to set priorities among them. A list of questions was produced along with a recommended approach to doing research in the technology transfer field. Brief papers by researchers on various aspects of technology transfer and developing nations are included. GRA

N75-32963# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
RESEARCH PRIORITIES ON TECHNOLOGY TRANSFER TO DEVELOPING COUNTRIES, VOLUME 2. SURVEY OF SELECTED STUDIES AND RESEARCH ON TECHNOLOGY TRANSFER TO DEVELOPING COUNTRIES
Nancy Beach Jul. 1974 63 p refs Revised
(Grant NSF GI-39239)
(PB-242315/0; NSF/RA/X-74-041-Vol-2) Avail: NTIS HC $4.25 CSCL 05A

This literature and research survey and bibliography (260 entries) was prepared for use at two NU/NSF workshops on technology transfer to developing countries. It has been amended to take into account several suggestions made by workshop participants. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N75-32964 Case Western Reserve Univ., Cleveland, Ohio.
A STUDY OF CARBON STARS WHOSE SPECTRA HAVE SHOWN SiC2 BANDS Ph.D. Thesis
Cynthia Emberson Irvine 1975 95 p
Avail: Univ. Microfilms Order No. 75-19275

Spectroscopic and photoelectric data were used to study the N-type carbon stars showing bands of SiC2. The correlation between the strength of the SiC2 bands and the violet depression was confirmed and it was found that (B-V) sub o provides a good indication of SiC2 strength. Both the UBV photometry and a comparison of the strength of the SiC2 bands with infrared observations supports the hypothesis of Gilra and Code (1971) that the violet opacity is due to SiC. Strong SiC2 bands are usually associated with large carbon abundance parameters; the reverse is not necessarily true. Several stars having variable SiC2 bands were found. Evidence is presented showing a possible link between the type of light variation and the strength of the SiC2 bands. The utility of the SiC2 bands in identifying strong SiC2 stars is discussed. Dissert. Abstr.

N75-32965 Florida Univ., Gainesville.
OPTICAL BRIGHTNESS AND POLARIZATION OF QUASARS AND RELATED OBJECTS Ph.D. Thesis
Ben Quiller McGimsey, Jr. 1974 140 p
Avail: Univ. Microfilms Order No. 75-19361

Photographic monitoring of quasars and related objects revealed several with definite or suspected variability. One type of observed variability consists of a violent optical outburst with

rapid rise and decay times; the other is more slowly varying with a gradual rise and fall in brightness. Regular observations of the optically violent variables OB 338, OX 074, PKS 0518+16, PKS 2345-16, NRAO 512, and 3C 371 revealed that they continue to undergo violent optical outbursts of a magnitude or more with flares. Results indicate that major flares in optically violent objects tend to be followed by several minor flares of decreasing amplitude and a decline in brightness. Furthermore, optical linear polarimetric observations indicate that the object BL Lac has a large, rapidly varying linearly polarized component, the Seyfert Galaxy 3C 120 has a smaller and more slowly varying component, and the quasar 3C 273 has none. There appears to be a positive correlation between optical activity and the magnitude and variability of the linearly polarized component.
Dissert. Abstr.

N75-32966 Harvard Univ., Cambridge, Mass.
AN EXPLANATION OF THE SUPER-METAL-RICH PHENOMENON IN FIELD K GIANTS AS AN EFFECT OF ATMOSPHERIC STRUCTURE Ph.D. Thesis
Ruth Carol Peterson 1974 99 p
Avail: Univ. Microfilms Order No. 75-18083

The super-metal-rich (SMR) phenomenon in K giants was examined. Three field K giants (one SMR) of the same R-I color and spectral type were observed at high resolution (2 A/mm) in the yellow. A direct determination of their relative metal abundances was made using the ratios of the strengths of weak lines. This shows that every element for which lines less than 300 mA are present has the same abundance in all three stars. The average metal abundance of the SMR star is within 5 percent of the average abundance of the standards. There is a noticeable dependence on excitation potential of the ratios of the strengths of particular lines, namely those of the neutral species of elements with low ionization potential. After considering how the weak lines are formed, it is concluded that a temperature drop exists in the SMR star relative to the normal stars, in the region just above where the continuum is formed.
Dissert. Abstr.

N75-32967 Arizona Univ., Tucson.
THERMIONIC EMISSION AND PULSAR MAGNETOSPHERES Ph.D. Thesis
Neil David Lubart 1975 134 p
Avail: Univ. Microfilms Order No. 75-19585

Approximate calculations that show a neutron star (with a strong surface magnetic field) to be solid at extremely elevated temperatures are presented. If the surface is solid, then only a few known emission mechanisms exist capable of supplying the necessary charged particles which are subsequently accelerated by the electromagnetic field near the pulsars. The calculation of the cohesive energy and melting temperature of the neutron star surface, with the composition ranging from helium to iron, is treated. The cohesive energy was computed using the cellular approximation. The electron work function was computed using Koopmans' Theorem. The iron work function was computed using thermodynamic arguments. Thermionic emission is shown to be able to supply copious numbers of ions and electrons at least during the early life of pulsars.
Dissert. Abstr.

N75-32968*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEW RESULTS FROM LONG-TERM OBSERVATIONS OF Cyg X-1
S. S. Holt, E. A. Boldt, P. J. Serlemitsos, and L. J. Kaluzienski (Maryland Univ., College Park) Aug. 1975 14 p refs Submitted for publication
(NASA-TM-X-70970; X-661-75-205) Avail: NTIS HC $3.25 CSCL 03A

Observations of Cyg X-1 between October 1974 and July 1975 reveal a persistent 5.6 day modulation of the 3 to 6 keV X-ray intensity, having a minimum in phase with superior conjunction of the HDE 226868 binary system. The modulation is found to be most pronounced just prior to the April-May 1975 increase of Cyg X-1, after which both the modulation and intensity are at their lowest values for the entire duration of the observations. These data imply that the X-ray emission from Cyg X-1 arises from the compact member of HDE 226868, and that the increase of April-May 1975 may have represented the depletion of accreting material which was not mixed into a cylindrically symmetric accretion disk about the compact member.
Author

N75-32969*# Scientific Translation Service, Santa Barbara, Calif.
THE 100 METER RADIO TELESCOPE FOR THE MAX PLANCK INSTITUTE FOR RADIO ASTRONOMY-BONN
E. Geldmacher Washington NASA Oct. 1975 26 p Transl. into ENGLISH from Tech. Mitt. Krupp-Werkberichte (Essen), v. 28, 1970 11 p Sponsored by NASA
(NASA-TT-F-14799) Avail: NTIS HC $3.75 CSCL 03A

The general concept of the telescope is presented along with the structural details. Structural details include telescope mounting, foundation, track runway rail and kingpin, running gear and azimuth drive, steel structure, reflector support structure and cladding, auxiliary reflector, and elevation drive.
M.J.S.

N75-32970*# Scientific Translation Service, Santa Barbara, Calif.
THE 100 m RADIO TELESCOPE OF THE MAX-PLANCK INSTITUTE
B. H. Grahl Washington NASA Oct. 1975 28 p Transl. into ENGLISH from the mono. "Das 100 m-Radioteleskop des Max-Plank-Instituts fuer radioastronomie" Bonn, Max-Planck Inst. for Radio Astronomy 9 p
(NASA-TT-F-16700) Avail: NTIS HC $3.75 CSCL 03A

The Krupp design and its construction principles for radio telescopes are outlined. The observational capability of the telescopes are discussed.
E.H.W.

N75-32971*# Martin Marietta Corp., Denver, Colo.
ORBITAL ASSEMBLY AND MAINTENANCE STUDY. EXECUTIVE SUMMARY Final Report
D. Gorman, C. Grant, G. Kyrias, C. Lord, J. P. Rombach, M. Salis, R. Skidmore, and R. Thomas Aug. 1975 45 p
(Contract NAS9-14319)
(NASA-CR-144448; MCR-75-319-2) Avail: NTIS HC $3.75 CSCL 03A

A sound, practical approach for the assembly and maintenance of very large structures in space is presented. The methods and approaches for assembling two large structures are examined. The maintenance objectives include the investigation of methods to maintain five geosynchronous satellites. The two assembly examples are a 200-meter-diameter radio astronomy telescope and a 1,000-meter-diameter microwave power transmission system. The radio astronomy telescope operates at an 8,000-mile altitude and receives RF signals from space. The microwave power transmission system is part of a solar power satellite that will be used to transmit converted solar energy to microwave ground receivers. Illustrations are included.
Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N75-32972 Columbia Univ., New York.
TWO-FLUID ANALYSIS OF RADIATION-MATTER COUPLING VIA COMPTON SCATTERING Ph.D. Thesis
Shyu-Hsien Hsieh 1975 142 p
Avail: Univ. Microfilms Order No. 75-18388

A two-fluid model of a fully ionized gas coupled to radiation via Compton scattering was utilized for the study of radiative hydrodynamics. Moment equations were derived in the small velocity weak field limit from the coupled covariant Boltzmann equations of radiation and matter. The resultant nonlinear two fluid equations exhibit both thermal and dynamical coupling. Momentum transfer from radiation to matter in the standard theory of radiative transfer can be recovered and Castors v/c effects are included. In addition, there is dynamical heating of matter due to macroscopic matter motion against the radiation. The effects of two-fluid coupling were studied via the linear stability analysis of the Jeans problem and the oscillations in radiative atmospheres. The model predicts gravitationally unstable modes at wavelengths slightly greater than the Jeans wavelength of matter alone. The model was applied to the analysis of plane-stratified atmospheres.
Dissert. Abstr.

N75-32973 Yeshiva Univ., New York.
THE ROTATION OF THE UNIVERSE Ph.D. Thesis
Alphonsus John Fennelly 1975 143 p
Avail: Univ. Microfilms Order No. 75-20584

Present beliefs in cosmology are reviewed, and it was demonstrated that the Copernican or modesty principle is neither Copernican nor modest. Applied to the usual concept of homogeneous vorticity this leads to a logical contradiction in that observers' determination of the peculiar velocity of an object at the intersection of their light cones will be inconsistent. Empirically this represents a paradox which could be an experimental test to determine if the vorticity of the universe is homogeneous or if it is nonsurfaceforming. Previous formalisms developed mainly in Cambridge, Maryland, and Moscow were critically examined. It is shown that a class of solutions may exist which contain a counterexample to these theorems. That counterexample was found and illustrated. Results of the group at Moscow and a theorem developed by the Berkeley group show that the Maryland program, while succeeding in isotropizing the universe and homogenizing it, generate and augment global vorticity of the universe. Dissert. Abstr.

N75-32974 California Inst. of Tech., Pasadena.
A THEORY OF STRONG AND WEAK SCINTILLATIONS WITH APPLICATIONS TO ASTROPHYSICS Ph.D. Thesis
Lou-Chuang Lee 1975 297 p
Avail: Univ. Microfilms Order No. 75-20000

The propagation of waves in an extended, irregular medium was studied under the quasi-optics and the Markov random process approximations. A Fokker-Planck equation satisfied by the characteristic functional of the random wave field was derived. A complete set of the moment equations were then obtained. The moment equations were solved for the phase correlation function, angular broadening, temporal pulse smearing, intensity correlation function, and the probability distribution of the random waves. The problem of diffraction of waves by a random, phase-changing screen is considered. The method of smooth perturbations was applied to interplanetary scintillations. The effects of the solar-wind velocity fluctuations on the observed intensity power spectrum were calculated. The observed interstellar scintillation data was interpreted using the theories derived under the Markov approximation. The Kolmogorov power-law spectrum fits the scintillation data and the ambient average electron density in the interstellar medium is about 0.025 cu/cm.
Dissert. Abstr.

N75-32975 California Inst. of Tech., Pasadena.
THE LUMINOSITY FUNCTION FOR GALAXIES AND THE CLUSTERING OF GALAXIES Ph.D. Thesis
Paul Schecter 1975 80 p
Avail: Univ. Microfilms Order No. 75-20012

An analytic representation for the luminosity function for galaxies is proposed. Best fits of this function to counts of nearby bright galaxies and to counts of galaxies in rich clusters were obtained. The proposed representation contains a characteristic magnitude which exhibits an equivalent dispersion of only .24 magnitudes from cluster to cluster. The narrow dispersion in absolute magnitude observed for the brightest members of clusters is understood in large part as statistical fluctuation about a universal luminosity function, but the correlation of absolute magnitude with richness expected from the proposed representation is not observed. It is shown that galaxies will condense into clusters of the sizes presently observed if the perturbations giving rise to galaxies were randomly distributed at recombination. Dissert. Abstr.

N75-32976 Princeton Univ., N.J.
ON THE IONIZATION OF THE INTERCLOUD MEDIUM BY O-B RUNAWAY STARS Ph.D. Thesis
Trinh Xuan Thuan 1974 112 p
Avail: Univ. Microfilms Order No. 75-20669

The ionization structure around high-velocity stars with spectral type varying from O5 to B1 was investigated. The radiative transfer problem was solved with the 'on the spot' approximation and the time-dependent cooling and recombination behind the star were taken into account. The contrasting properties of the front and the back of the HII region around a moving star are studied in the case of a star with T sub e = 35000 K, moving with v = 50 km/s in an uniform medium of 0.1 H atoms cu cm. Directly in front of the star, the ionization time of H (cm = 20,000 years) at the edge of the HII region is about 65 times smaller than the recombination time, steady-state is reached after about 1,500,000 years, the I-front radius is compressed (140 pc compared to 190 pc when v = 0), the transition from completely ionized to completely neutral is very sharp, the optical depth at the edge very small and the ratio NI/NII 11 times smaller than its value at v = 0. Dissert. Abstr.

N75-32977 Princeton Univ., N.J.
QUANTIZATION OF A SCALAR FIELD IN THE KERR SPACETIME Ph.D. Thesis
Lawrence Howard Ford 1974 124 p
Avail: Univ. Microfilms Order No. 75-20632

A discussion of field quantization in a curved background spacetime is presented, with emphasis on the quantization of a scalar field in the Kerr spacetime. Ambiguity in the choice of a Fock space is discussed. The example of quantized fields in a rotating frame of reference in Minkowski space is analyzed, and it is shown that there is a preferred choice of states which makes particle number an invariant under transformation to the rotating frame. This choice allows the existence of negative energy quanta of the field. The Klein-Gordon equation in the Kerr metric is studied and some properties of its solutions reviewed. The quantum mechanics of a single scalar particle in a Kerr gravitational field is developed in terms of the Feshbach-Villars two-component formalism. In particular, the weak field limit of this equation is examined. The limits of the single particle theory are pointed out. A perturbation analysis is used to determine the single particle energy levels as functions of the angular momentum of the Kerr field. Dissert. Abstr.

N75-32978*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BOW SHOCK AND MAGNETOSHEATH WAVES AT MERCURY
D. H. Fairfield and K. W. Behannon Jul. 1975 37 p refs Submitted for publication
(NASA-TM-X-70965; X-692-75-177) Avail: NTIS HC $3.75 CSCL 03B

Mariner 10 measurements at the Mercury bow shock provide examples where the magnetic field is approximately parallel or perpendicular to the bow shock normal. Upstream of a broad irregular parallel shock, left hand circularly polarized waves are observed which cut off very sharply at approximately 4 Hz. Upstream of a perpendicular shock, right hand circularly polarized waves are observed which persist up to the Nyquist frequency of 12 Ha. Determination of the wave propagation vector as a function of frequency helps conclusively identify the waves as whistler mode waves propagating from the shock. The magnetosheath downstream of the parallel shock is disturbed more than that downstream of the perpendicular shock particularly below 1 Hz. In the latter case regular left hand polarized waves observed slightly above the proton gyrofrequency are identified as ion cyclotron waves with wavelength approximately 300 km which are Doppler shifted up to their observed frequency.
Author

N75-32979*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
ESTIMATING THE ACCURACY OF THE THEORIES OF MOTION OF THE EARTH AND MARS
V. L. Mazo Washington NASA Sep. 1975 16 p refs Transl. into ENGLISH from Byull. Inst. Teor. Astron. (USSR), v. 13, no. 13 (153), 1975 p 629-635
(Contract NASw-2789)
(NASA-TT-F-16306) Avail: NTIS HC $3.25 CSCL 03B

Attempts made to evaluate the accuracy of Newcomb's theory for earth motion, as well as that of Clemence's theory for the motion of Mars are reported. The consideration is based on the general algorithm applied to the prognosis accuracy evaluation in the case of cosmic probes motion, according to the influence of random fluctuations of so called interferring parameters.
Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N75-32980 Boston Univ., Mass.
MORPHOLOGICAL CHARACTERISTICS OF HADLEY RILLE, THE MOON Ph.D. Thesis
Thomas Brewer 1975 329 p
Avail: Univ. Microfilms Order No. 75-20981

The morphology of Hadley Rille and its relationship to surrounding structures was investigated. The rille is contained within mare basalts and appears to have been deflected by pre-mare material. It is cut by post-mare craters but cuts no such crater. Irregular depressions at either end appear volcanic in origin. Transverse profiles indicate that the southern section has a V-shaped profile with mildly concave limbs and no natural levees. U-shaped or asymmetric profiles have resulted from post-file alteration. The power spectrum and meander wavelength of the rille are similar to values for terrestrial rivers. Statistical tests show that the width decreases northward, is directly correlated with depth, and shows abrupt increases followed by gradual tapering to the north. Limited segments show a width-azimuth relationship. It is proposed that the rille is a channel which returned lava to the southern vent from which it initially extruded and persisted through many volcanic episodes.
Dissert. Abstr.

N75-32981 Arizona Univ., Tucson.
NUMERICAL MODELING OF THE DIURNAL WINDS NEAR THE MARTIAN POLAR CAPS Ph.D. Thesis
Stephen Dwight Burk 1975 148 p
Avail: Univ. Microfilms Order No. 75-19607

On Mars in the summer occurs marked diurnal variations in surface temperature, while the ice cap remains near the CO2 sublimation temperature. This creates an intense, diurnally varying baroclinic zone. A similar situation occurs for terrestrial sea-land breezes. A model of a seabreeze is presented. It is assumed that the atmosphere is at rest and that surface temperatures and pressures are uniform. When bare ground warms the overlying atmosphere columns are heated by turbulent heat transfer through the surface boundary layer (SBL). The Martian circulation is shown to be deeper and stronger than its terrestrial counterpart. A theoretical analysis estimated the Martian SBL depth to be two to four times greater than that of earth. Eddy heat transfer is proposed to be the major cause of the intense Baroclinic zone on Mars. A theory of sand dune movement was utilized for estimating the dust-lifting potential of the winds developed in the model. It appears that these winds alone are incapable of dust lifting.
Dissert. Abstr.

N75-32982 California Inst. of Tech., Pasadena.
SPATIALLY RESOLVED ABSOLUTE SPECTRAL REFLECTIVITY OF JUPITER: 3390-8400 ANGSTROMS, 1. THE JOVIAN THERMAL STRUCTURE FROM PIONEER 10 INFRARED RADIOMETER DATA, 2. OBSERVATIONS AND ANALYSIS OF 8/14 MICRON THERMAL EMISSION OF JUPITER: A MODEL OF THERMAL STRUCTURE AND CLOUD PROPERTIES, 3 Ph.D. Thesis
Glenn Scott Orton 1975 187 p
Avail: Univ. Microfilms Order No. 75-20007

Absolute reflectivities of different regions of Jupiter were obtained with the Mt. Wilson 60 inch telescope. The dependence of reflectivity on wavelength is shown. Effective reflectivities for regions on the meridian are given, including the South Tropical Zone, North Tropical Zone, South Equatorial Belt, North Equatorial Belt and the Great Red Spot. Reflectivities nearer the limb were also observed. Secondly, latitude sectors of the 20 and 40 micron maps of Jupiter obtained by the Pioneer 10 infrared radiometer were used to derive simple models for the average vertical thermal structure over the South Equatorial Belt and the South Tropical Zone. Additional Examples of models for the North Equatorial Belt and the Great Red Spot are given. Finally, observations made with the 200 inch polomar telescope of the limb structure near the equator at 8.15 and 8.44 microns are reported. A model of the thermal structure and cloud properties of the atmosphere was developed which is consistent with the 8-14 micron range.
Dissert. Abstr.

N75-32983*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
SUBSTORMS ON MERCURY?
G. L. Siscoe, N. F. Ness, and C. M. Yeates Jul. 1974 23 p refs
(Grant NGL-22-009-015)
(NASA-CR-143509; CSR-TR-75-1) Avail: NTIS HC $3.25 CSCL 03B

Qualitative similarities between some of the variations in the Mercury encounter data and variations in the corresponding regions of the earth's magnetosphere during substorms are pointed out. The Mariner 10 data on Mercury show a strong interaction between the solar wind and the plant similar to a scaled down version of that for the earth's magnetosphere. Some of the features observed in the night side Mercury magnetosphere suggest time dependent processes occurring there.
Author

N75-32984# Lockheed Missiles and Space Co., Palo Alto, Calif.
CONCENTRATION OF METEORIC MATTER NEAR THE EARTH
T. N. Nazarova and A. K. Rybakov 1974 3 p Transl. into ENGLISH from Astron. Tsirk. (USSR), 9 Aug. 1974 p 3-4
Avail: NTIS HC $3.25; National Translation Center, John Crerar Library, Chicago, Ill. 60616

Direct studies of meteoric matter near earth at 200 - 400 km ranges from its surface (Kosmos-470, 502, 541) were performed by using identical apparatus, including condenser and luminescent detectors. The measurement results showed that the integrated flux of meteoric particles is approximately one and one-half orders greater at 200 km from earth than at 300 km ranges, where it is similar in magnitude to the flux in interplanetary space.
Author

N75-32985*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A TECHNIQUE FOR CONSTRUCTING SPECTRAL REFLECTANCE CURVES FROM VIKING LANDER CAMERA MULTISPECTRAL DATA
Stephen K. Park, Friedrich O. Huck, and Brent D. Martin Sep. 1975 20 p refs
(NASA-TM-X-72773) Avail: NTIS HC $3.25 CSCL 03B

A technique for evaluating the construction of spectral reflectance curves from multispectral data obtained with the Viking lander cameras is presented. The multispectral data is limited to 6 channels in the wave-length range 0.4 to 1.1 microns, and several of the channels suffer from appreciable out-of-band response. The technique represents the estimated reflectance curves as a linear combination of known basic functions with coefficients determined to minimize the error in the representation, and it permits all channels, with and without out-of-band response, to contribute equally valid information. The technique is evaluated for known spectral reflectance curves of 8 materials felt likely to be present on the Martian surface. The technique provides an essentially exact fit if the the reflectance curve has no pronounced maxima and minima. Even if the curve has pronounced maxima and minima, the fit is good and reveals the most dominant features. Since only 6 samples are available some short period features are lost. This loss is almost certainly due to undersampling rather than out-of-band channel response.
Author

N75-32986*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPECTRAL RESPONSE OF THE VIKING LANDER CAMERA: PRELIMINARY EVALUATION
W. Lane Kelly, IV, Friedrich O. Huck, and Raymond E. Arvidson Sep. 1975 28 p refs
(NASA-TM-X-72778) Avail: NTIS HC $3.75 CSCL 03B

One of the objectives of the Viking lander imaging investigation is to obtain color and near-infrared multispectral panoramas of the Martian surface using six spectral channels in the 0.4 to 1.1 microns wavelength range. This data can be compared with data obtained by imaging a reference test chart to construct

approximate spectral reflectance curves that can then be matched to laboratory standards to aid in identifying surface materials. Some channels exhibit appreciable out-of-band spectral responses, making data reduction and interpretation difficult. A preliminary evaluation of predicted multispectral data for eight geological materials reveals that fairly good reflectance estimates can be made for those materials which have monotonically increasing or decreasing reflectances. Reflectance estimates for materials with more complex reflectances often do not reveal important spectral features and sometimes provide misleading results.
Author

N75-32987*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE STUDY OF THE PHYSICS OF COMETARY NUCLEI Semiannual Progress Report, 1 Mar. - 31 Aug. 1975
Fred L. Whipple, Brian G. Marsden, and Zdenek Sekanina Sep. 1975 18 p refs
(Grant NsG-7082)
(NASA-CR-119138; SAPR-2) Avail: NTIS HC $3.25 CSCL 03B

Research in the area of split and hyperbolic comets, orbital calculations, and interstellar comets is discussed. Other topics discussed include the role of comets in galactic chemistry, gamma ray bursts, and predicted favorable visibility conditions for anomalous tails of comets.
M.J.S.

N75-32988*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
DYNAMICAL AND PHOTOMETRIC INVESTIGATION OF COMETARY TYPE 2 TAILS Semiannual Progress Report, 15 Mar. - 14 Sep. 1975
Zdenek Sekanina 14 Sep. 1975 63 p refs
(Grant NGR-09-015-159)
(NASA-CR-119137; SAPR-8) Avail: NTIS HC $4.25 CSCL 03B

The absolute calibration of the photometric profile of the antitail of Comet Kohoutek 1973 XII on plates taken with the Curtis Schmidt telescope of the University of Michigan at the Cerro Tololo Inter-American Observatory is described in detail. The formula for the determination of the air mass, and the correction for atmospheric absorption and for the loss of light due to vignetting are included. The calibration stars were used to derive the coefficients converting the relative intensity scale to the absolute surface-brightness units. The extensive results of the study of the orbital evolution of vaporizing dust particles are listed in a tabular form. Gradual evaporation from the surface of a particle results typically in its expulsion from the solar system. The properties of the particle and the elements of its orbit at expulsion are given as functions of the particle's properties and orbit before appreciable evaporation commenced. Also given are circumstances at an encounter of an expelled particle with the earth as a function of the particle's properties. A few specific cases are represented graphically.
Author

N75-32989*# National Aeronautics and Space Administration, Washington, D.C.
SURFACE MODELS OF MARS, 1975 NASA Space Vehicle Design Criteria (Environment)
Sep. 1975 84 p refs Revised
(NASA-SP-8020) Avail: NTIS HC $4.75 CSCL 03B

Data derived from Mariners 6, 7, and 9, Russian Mars probes, and photographic and radar observations conducted from earth are used to develop engineering models of Martian surface properties. These models are used in mission planning and in the design of landing and exploration vehicles. Optical models needed in the design of camera systems, dielectric properties needed in the design of radar systems, and thermal properties needed in the design of the spacecraft thermal control system are included.
J.M.S.

N75-32990*# Hardin-Simmons Univ., Abilene, Tex.
RESPONSE OF SELECTED MICROOGANISMS TO EXPERIMENTAL PLANETARY ENVIRONMENTS Semiannual Progress Report, 1 Jan. - 30 Jun. 1975
Terry L. Foster Aug. 1975 37 p
(Grant NGR-44-095-001)
(NASA-CR-119146; SAPR-6) Avail: NTIS HC $3.75 CSCL 03B

A microbial population profile of mixed Cape Canaveral soil samples is presented. During this investigation a few organisms were isolated which exhibit the ability to grow at 3 C, 32 C, and 55 C. Growth curves are shown for three of these isolates, one of which grows extremely well at all three temperatures. Also included are studies dealing with growth of soil populations at zero and subzero temperatures. Results indicate growth at 0 C and -5 C, but not at 15 C or -65 C. The effect of storage temperature on dry soil is presented, and results show that psychrophilic populations decrease when soil is stored at room temperature, but do not decrease when soil is stored at -65 C. Results of an experiment with the simulated Martian environment are presented and indicate that nonsporeforming rods, sporeforming rods, and cocci can reproduce in the simulated environment when nutrients and moisture are supplied. The sporeforming rods are the predominant suvivors when dry soil is subjected to this environment.
Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

No abstracts in this category.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N75-32991 Florida Univ., Gainesville.
THREE-COLOR PHOTOGRAPHIC PHOTOMETRY OF ACTIVE QUASI-STELLAR RADIO SOURCES Ph.D. Thesis
Karen Robinson Hunt Hackney 1973 230 p
Avail: NTIS Avail: Univ. Microfilms Order No. 75-19408

Statistically significant optical variations were detected at Rosemary Hill Observatory in studies of the quasars and quasar-like objects PKS 0048-09, PKS 0336-01, PKS 0420-01, PKS 0518+16, PKS 0735+17, PKS 2111-25, PKS 2209+08, PKS 2354-11, OB 338, OI 318, OK 290, and OL 318. These sources comprised about 40 percent of the sample of 28 objects for which numerous photographic plates were measured with an iris photometer. The detection of variability in the objects PKS 2111-25, PKS 2209+08, PKS 2354-11, OB 338, and OL 318 supports the previously suggested optical identifications that were based only on color and proximity to the radio source positions. The large-amplitude variability of PKS 0735+17 is especially noteworthy in connection with its featureless optical spectrum and its consequent similarity to the active peculiar sources BL Lac and OJ 287.
Dissert. Abstr.

N75-32992 Princeton Univ., N.J.
SEARCH FOR SHORT TIME-SCALE RADIO FLUCTUATIONS Ph.D. Thesis
Lawrence Rudnick 1974 173 p
Avail: Univ. Microfilms Order No. 75-20657

A number of extragalactic radio sources and spiral galaxies were studied for broadband radio fluctuations, and for measuring the density of the intergalactic plasma. Limits in the range of 100 to 500 m.f.u. root mean square were set on possible fluctuations for time-scales of seconds or less. A search was also made for broadband fluctuations and highly dispersed pulsars in the Galaxy, in the direction of the Galactic Center, and along tangents to prominent spiral arms. No new pulsars were found with dispersion measures less than approximately 1500 P p/cu/cm where P is the pulsar period, in seconds, and with luminosities greater than about 20 m.f.u.
Dissert. Abstr.

N75-32993*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO 17 MISSION REPORT. SUPPLEMENT 6: CALIBRATION RESULTS FOR GAMMA RAY SPECTROMETER SODIUM IODIDE CRYSTAL Final Report
C. Dyer and J. I. Trombka Mar. 1975 20 p refs
(NASA-TM-X-72516; JSC-07904-Suppl-6; X-682-74-342-Suppl-6) Avail: NTIS HC $3.25 CSCL 03B

A major difficulty in medium energy gamma-ray remote sensing spectroscopy and astronomy measurements was the high rate of unwanted background resulting from the following major sources: (1) prompt secondary gamma-rays produced by cosmic-ray interactions in satellite materials; (2) direct charged-particle counts; (3) radioactivity induced in the detector materials by cosmic-ray and trapped protons; (4) radioactivity induced in detector materials by the planetary (e.g., earth or moon) albedo neutron flux; (5) radioactivity induced in the detector materials by the interaction of secondary neutrons produced throughout the spacecraft by cosmic-ray and trapped proton interactions; (6) radioactivity induced in spacecraft materials by the mechanisms outlined in 3, 4, and 5; and (7) natural radioactivity in spacecraft and detector materials. The purpose of this experiment was to obtain information on effects 3, 4, and 5, and from this information start developing calculational methods for predicting the background induced in the crystal detector in order to correct the Apollo gamma-ray spectrometer data for this interference.
Author

N75-32994# Lockheed Missiles and Space Co., Palo Alto, Calif.
FLUX OF HIGH ENERGY ELECTRONS AT 200-300 km ALTITUDES ACCORDING TO KOSMOS-264 RESULTS
A. M. Galper, A. F. Iiudin, B. I. Luchkov, Iu. V. Ozerov, and V. T. Samoilenko [1975] 4 p refs Transl. into ENGLISH from Kosmich. Issled., v. 13, no. 3, 1975 p 437-439
Avail: NTIS HC $3.25; National Translation Center, John Crerar Library, Chicago, Ill. 60616

A spark gamma-telescope was used to record high energy electrons on the Kosmos 264. Results are presented and discussed.
M.J.S.

N75-32995*# Chicago Univ., Ill. Lab. for Astrophysics and Space Research.
OGO-5 EXPERIMENT E-09 COSMIC RAY ELECTRONS Final Report
Peter Meyer 5 Jun. 1975 3 p refs
(Contract NAS5-9096)
(NASA-CR-144668) Avail: NTIS HC $3.25 CSCL 03B

Cosmic ray spectra and solar electron data in the 10 to 200 MeV range, as measured by experiment E-09 on OGO-5, are reported.
E.H.W.

N75-32996*# National Oceanic and Atmospheric Administration, Boulder, Colo.
H-ALPHA SYNOPTIC CHARTS OF SOLAR ACTIVITY DURING THE FIRST YEAR OF SOLAR CYCLE 20, OCTOBER 1964 - AUGUST 1965
Patrick S. McIntosh Mar. 1975 31 p refs
(Grants NGR-30-002-097; NOAA-03-3-022-41)
(NASA-CR-143533; COM-75-50279-41; NOAA-75032410) Avail: NTIS HC $3.75; paper copy avail. from National Climatic Center, Federal Bldg. Attn: Publications, Asheville, N. C. 28801. $25.20/year, $0.48/copy this issue CSCL 03B

Solar activity during the period October 28, 1964 through August 27, 1965 is presented in the form of charts for each solar rotation constructed from observations made with the chromospheric H-alpha spectra line. These H-alpha synoptic charts are identical in format and method of construction to those published for the period of Skylab observations. The sunspot minimum marking the start of Solar Cycle 20 occurred in October, 1964; therefore, charts represent solar activity during the first year of this solar cycle.
GRA

99 GENERAL

N75-32997*+ National Aeronautics and Space Administration, Washington, D.C.
SIGNIFICANT NASA INVENTIONS: AVAILABLE FOR LICENSING IN FOREIGN COUNTRIES
1975 106 p
(NASA-SP-7038(03)) Avail: NTIS; SOD HC $1.40 CSCL 05B

Abstracts are given of various NASA-owned inventions which are available for foreign licensing in the identified countries in accordance with the NASA Foreign Patent Licensing Regulations.
Author

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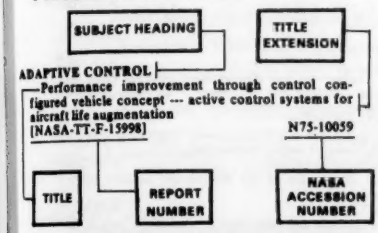

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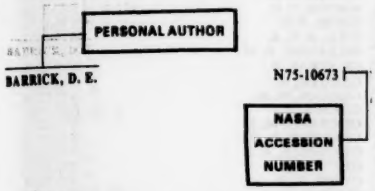

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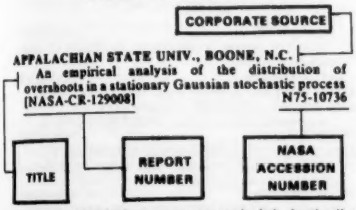

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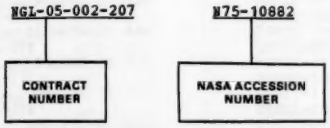

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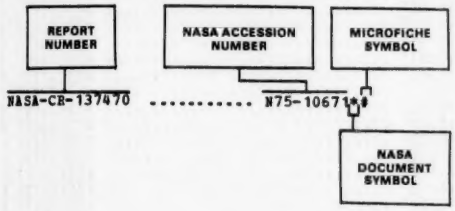

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AD-A010107 ..... N75-32157 #
AD-A010108 ..... N75-32181 #
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AD-A010158 ..... N75-32156 #
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AD-A010221 ..... N75-32806 #
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AD-A010223 ..... N75-32457 #
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AD-A010228 ..... N75-32300 #
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AD-A010281 ..... N75-32295 #
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AD-A010314 ..... N75-32777 #
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AD-A010335 ..... N75-32673 #
AD-A010338 ..... N75-32333 #
AD-A010340 ..... N75-32474 #
AD-A010350 ..... N75-32779 #
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AD-A010355 ..... N75-32406 #
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AD-A010387 ..... N75-32257 #
AD-A010388 ..... N75-32185 #
AD-A010393 ..... N75-32344 #
AD-A010396 ..... N75-32800 #
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AD-A010403 ..... N75-32265 #
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AD-A010407 ..... N75-32935 #
AD-A010408 ..... N75-32401 #
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AD-A010422 ..... N75-32514 #
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AD-A010428 ..... N75-32511 #
AD-A010429 ..... N75-32621 #
AD-A010434 ..... N75-32700 #
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AD-A010438 ..... N75-32677 #
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AD-A010454 ..... N75-32285 #

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AD-A010457 ..... N75-32453 #
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AD-A010459 ..... N75-32445 #
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AD-A010472 ..... N75-32454 #
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AD-A010477 ..... N75-32287 #
AD-A010480 ..... N75-32199 #
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AD-A010491 ..... N75-32227 #
AD-A010492 ..... N75-32129 #
AD-A010497 ..... N75-32237 #
AD-A010500 ..... N75-32163 #
AD-A010502 ..... N75-32867 #
AD-A010504 ..... N75-32417 #
AD-A010507 ..... N75-32207 #
AD-A010508 ..... N75-32244 #
AD-A010509 ..... N75-32675 #
AD-A010510 ..... N75-32243 #
AD-A010511 ..... N75-32291 #
AD-A010512 ..... N75-32228 #
AD-A010513 ..... N75-32855 #
AD-A010514 ..... N75-32256 #
AD-A010515 ..... N75-32679 #
AD-A010516 ..... N75-32455 #
AD-A010519 ..... N75-32293 #
AD-A010521 ..... N75-32728 #
AD-A010522 ..... N75-32162 #
AD-A010525 ..... N75-32398 #
AD-A010527 ..... N75-32714 #
AD-A010530 ..... N75-32467 #
AD-A010531 ..... N75-32468 #
AD-A010532 ..... N75-32301 #
AD-A010534 ..... N75-32302 #
AD-A010538 ..... N75-32299 #
AD-A010539 ..... N75-32111 #
AD-A010541 ..... N75-32704 #
AD-A010542 ..... N75-32201 #
AD-A013128/4 ..... N75-32122 #
AD-A013129/2 ..... N75-32123 #
AD-A013131/8 ..... N75-32124 #
AD-A013187/7 ..... N75-32279 #
AD-A013343/9 ..... N75-32750 #
AD-A013351/2 ..... N75-32083 #

AD-776111/7 ..... N75-32085 #

AEDC-TR-75-46 ..... N75-32129 #

AEM-1 ..... N75-32083 #

AEROTHERM-75-152 ..... N75-32019*#

AESC-5014 ..... N75-32312 #

AFAL-TR-74-181 ..... N75-32289 #

AFAPL-TR-75-12 ..... N75-32242 #

AFCRL-AFSIG-301 ..... N75-32700 #

AFCRL-ERP-501 ..... N75-32663 #

AFCRL-PSRP-626 ..... N75-32450 #

AFCRL-TR-74-0380 ..... N75-32285 #
AFCRL-TR-74-0641 ..... N75-32668 #
AFCRL-TR-75-0092 ..... N75-32938 #
AFCRL-TR-75-0103 ..... N75-32700 #
AFCRL-TR-75-0105 ..... N75-32450 #
AFCRL-TR-75-0116 ..... N75-32660 #
AFCRL-TR-75-0150 ..... N75-32663 #
AFCRL-TR-75-0152 ..... N75-32453 #
AFCRL-TR-75-0165 ..... N75-32808 #
AFCRL-TR-75-0179 ..... N75-32678 #
AFCRL-TR-75-0181 ..... N75-32346 #
AFCRL-TR-75-C202 ..... N75-32677 #
AFCRL-TR-75-0205 ..... N75-32676 #
AFCRL-TR-75-0232 ..... N75-32437 #
AFCRL-TR-75-0257 ..... N75-32445 #
AFCRL-TR-75-0300 ..... N75-32206 #

AFFDL-TR-73-7-VOL-2 ..... N75-32514 #
AFFDL-TR-75-11 ..... N75-32248 #

AFHRL-TR-74-86 ..... N75-32757 #
AFHRL-TR-74-89 ..... N75-32107 #
AFHRL-TR-74-92 ..... N75-32756 #

AFHRL-TR-74-103 ..... N75-32752 #

AFML-TR-72-102-PT-3 ..... N75-32240 #
AFML-TR-73-213 ..... N75-32183 #
AFML-TR-74-75 ..... N75-32235 #
AFML-TR-74-210 ..... N75-32187 #
AFML-TR-74-259 ..... N75-32182 #

AFOSR-74-0161TR ..... N75-32666 #
AFOSR-74-1922TR ..... N75-32868 #
AFOSR-75-0336TR ..... N75-32404 #
AFOSR-75-0616TR ..... N75-32201 #
AFOSR-75-0621TR ..... N75-32844 #
AFOSR-75-0669TR ..... N75-32207 #
AFOSR-75-0712TR ..... N75-32417 #
AFOSR-75-0714TR ..... N75-32199 #
AFOSR-75-0716TR ..... N75-32867 #

AFRPL-TR-74-53-VOL-1 ..... N75-32440 #

AFWL-TR-73-75-VOL-1 ..... N75-32330 #
AFWL-TR-73-75-VOL-2 ..... N75-32331 #
AFWL-TR-73-289-VOL-1 ..... N75-32511 #
AFWL-TR-74-70 ..... N75-32621 #
AFWL-TR-74-174 ..... N75-32728 #
AFWL-TR-74-180 ..... N75-32138 #
AFWL-TR-74-191 ..... N75-32288 #
AFWL-TR-74-222 ..... N75-32936 #

AGARD-AG-203 ..... N75-32001 #
AGARD-AG-209-VOL-1 ..... N75-32047 #
AGARD-AG-209-VOL-2 ..... N75-32066 #

AGARD-CP-170 ..... N75-32716 #
AGARD-CP-175 ..... N75-32096 #

AGARD-R-630 ..... N75-32015 #
AGARD-R-631 ..... N75-32014 #

AGARDOGRAPH-203 ..... N75-32001 #
AGARDOGRAPH-209-VOL-1 ..... N75-32047 #
AGARDOGRAPH-209-VOL-2 ..... N75-32066 #

AI-5 ..... N75-32809 #

AIRESEARCH-75-11994 ..... N75-32760*#

AMSRC-CTR-75-4 ..... N75-32510 #

AMRL-TR-74-79 ..... N75-32754 #
AMRL-TR-74-80 ..... N75-32130 #

APR-2 ..... N75-32619 #
APR-2 ..... N75-32620 #

AR-10 ..... N75-32935 #

ARDG(E)-R/D-2038 ..... N75-32405 #
ARDG(FE)-440-9 ..... N75-32935 #
ARDG(FE)-440-10 ..... N75-32935 #

ARI-TECH-PAPER-262 ..... N75-32779 #

ARL-75-0009 ..... N75-32452 #
ARL-75-0010 ..... N75-32407 #
ARL-75-0011 ..... N75-32937 #

ARO-PWT-TR-75-14 ..... N75-32129 #

ARO-VKF-TR-74-130 ..... N75-32036 #

ASD-TR-71-46 ..... N75-32751 #

AS113 ..... N75-32698 #

ATC-44 ..... N75-32279 #

ATL-TR-211 ..... N75-32199 #

ATR-74(7328)-1 ..... N75-32646 #
ATR-75(7487)-1 ..... N75-32647 #

AU-AFIT-SL-2-75 ..... N75-32956 #

AVSD-0362-74-RR ..... N75-32344 #

BBC-RD-1975/24 ..... N75-32270
BBC-RD-1975/25 ..... N75-32269
BBC-RD-1975/27 ..... N75-32275

BBC-RD-1975/28 ..... N75-32276

BBN-3067 ..... N75-32809 #

BER-199-94 ..... N75-32943*#

BLL-M-23551-(5828.4F) N75-32683

BM-OFR-34-75 ..... N75-32251 #
BM-OFR-35-75 ..... N75-32579 #

BM-RI-8024 ..... N75-32629 #

BM-TPR-84 ..... N75-32603 #

BRL-CR-224 ..... N75-32257 #

BRL-MR-2479 ..... N75-32795 #

BRL-1772 ..... N75-32434 #

BR43515 ..... N75-32241 #
BR48763 ..... N75-32735 #
BR48764 ..... N75-32745 #
BR48765 ..... N75-32504 #

BW-TR-565 ..... N75-32265 #

CAM-100-23 ..... N75-32509 #

CERL-IR-E-52 ..... N75-32952 #

CHI-QTR-101 ..... N75-32301 #

CLM/RR/E1/16 ..... N75-32907 #

COINS-TR-75C-1 ..... N75-32803 #
COINS-TR-75C-2 ..... N75-32804 #
COINS-TR-75C-3 ..... N75-32805 #

COM-75-10574/2 ..... N75-32665 #
COM-75-10618/7 ..... N75-32597*#
COM-75-10678/1 ..... N75-32155 #
COM-75-10679/9 ..... N75-32154 #
COM-75-10687/2 ..... N75-32204 #
COM-75-10736/7 ..... N75-32578 #
COM-75-50141-05 ..... N75-32268 #
COM-75-50214-02 ..... N75-32954 #
COM-75-50279-41 ..... N75-32996*#
COM-241391/2 ..... N75-32620 #

CONTRIB-3426 ..... N75-32173 #
CONTRIB-3452 ..... N75-32170 #

CRC-APRAC-CAPM-3-68-5 ..... N75-32740 #
CRC-APRAC-CAPM-3-68-6 ..... N75-32741 #
CRC-APRAC-CAPM-3-68-7 ..... N75-32738 #

CRC-274 ..... N75-32111 #
CRC-278 ..... N75-32286 #

CRREL-SR-43-PT-7 ..... N75-32662 #
CRREL-SR-221 ..... N75-32391 #

CRREL-TL-465 ..... N75-32659 #

CSC/TR-75/6007 ..... N75-32781 #

CSR-TR-75-1 ..... N75-32983*#

D-HAT-197 ..... N75-32241 #

DDC-TAS-75-10-REV ..... N75-32163 #

DGS-217 ..... N75-32668 #

DI-S-1800 ..... N75-32171 #

DNA-3499H-REV ..... N75-32300 #
DNA-3511F ..... N75-32672 #
DNA-3520T ..... N75-32680 #
DNA-3577F ..... N75-32335 #
DNA-3607Z ..... N75-32515 #

DOC-98M10001 ..... N75-32585*#

DOT-TSC-FHWA-75-1 ..... N75-32439 #

DOT-TSC-OST-75-12 ..... N75-32472 #

DOT-TSC-OST-75-13 ..... N75-32471 #
DOT-TSC-OST-75-15 ..... N75-32470 #

DOT-TST-75-90 ..... N75-32703 #
DOT-TST-75-91 ..... N75-32739 #

DOT/TES/OCA-75/2 ..... N75-32961 #

DPG-TR-75-310 ..... N75-32433 #

DREO-TN-74-3 ..... N75-32664 #

D2-118572 ..... N75-32764*#
D6-41789-PT-1 ..... N75-32026*#
D6-41789-PT-2 ..... N75-32027*#
D162-10310-1 ..... N75-32898 #
D180-18476-2 ..... N75-32260*#
D9192-950002 ..... N75-32385*#
D9192-954001 ..... N75-32384*#

E-8138 ..... N75-32593*#
E-8165 ..... N75-32789*#
E-8206 ..... N75-32125*#
E-8246 ..... N75-32167*#
E-8367 ..... N75-32616*#
E-8368 ..... N75-32118*#
E-8379 ..... N75-32224*#
E-8409 ..... N75-32872*#
E-8454 ..... N75-32120*#
E-8470 ..... N75-32591*#
E-8472 ..... N75-32595*#
E-8473 ..... N75-32153*#
E-8475 ..... N75-32594*#
E-8476 ..... N75-32463*#
E-8478 ..... N75-32592*#
E-8481 ..... N75-32927*#

ECOM-DR-75-2 ..... N75-32673 #

ECOM-74-0109-4 ..... N75-32599 #
ECOM-0039-F ..... N75-32328 #
ECOM-0319-8-71 ..... N75-32303 #
ECOM-4297 ..... N75-32088 #
ECOM-4303 ..... N75-32282 #
ECOM-4315 ..... N75-32327 #
ECOM-4321 ..... N75-32046 #
ECOM-4322 ..... N75-32340 #

EE-4038-102-75 ..... N75-32121*#

EERL-73-25-VOL-1-PT-T ..... N75-32681 #

EHL-74M-12 ..... N75-32780 #

EMG-158 ..... N75-32231 #

ENVPREDRSCHF-TECH-NOTE-18 ..... N75-32711 #

ENVPREDRSCHF-TECH-PAPER-8-75 ..... N75-32692 #
ENVPREDRSCHF-TECH-PAPER-16-74 ..... N75-32701 #

EOARD-TR-75-1 ..... N75-32675 #

EPA-230/1-75-002 ..... N75-32638 #
EPA-450/3-73-006-D-VOL-4 ..... N75-32628 #
EPA-450/3-74-045-A ..... N75-32637 #
EPA-450/3-74-052 ..... N75-32632 #
EPA-450/3-75-036 ..... N75-32635 #
EPA-450/3-75-038 ..... N75-32626 #
EPA-450/3-75-039 ..... N75-32600 #
EPA-450/3-75-056 ..... N75-32634 #
EPA-450/4-74-006-VOL-5 ..... N75-32640 #
EPA-460/3-74-021 ..... N75-32646 #
EPA-600/1-75-001 ..... N75-32618 #
EPA-600/4-75-001 ..... N75-32624 #
EPA-600/6-75-001 ..... N75-32639 #
EPA-600/6-75-002 ..... N75-32630 #
EPA-650/2-74-009-F ..... N75-32627 #
EPA-650/2-74-086-A-VOL-1 ..... N75-32408 #
EPA-650/2-74-086-B-VOL-2-APP ..... N75-32409 #
EPA-650/2-74-099 ..... N75-32577 #
EPA-650/2-75-012 ..... N75-32647 #
EPA-650/2-75-017 ..... N75-32606 #
EPA-650/2-75-027-A-VOL-1 ..... N75-32208 #
EPA-650/2-75-027-B-VOL-2 ..... N75-32209 #
EPA-650/2-75-030 ..... N75-32625 #
EPA-650/2-75-032-A ..... N75-32608 #
EPA-650/2-75-032-C ..... N75-32607 #
EPA-650/2-75-038 ..... N75-32631 #

EPA-650/4-74-045-A ..... N75-32619 #
EPA-650/4-74-045-B ..... N75-32620 #
EPA-670/2-75-002 ..... N75-32645 #
EPA-670/2-75-023 ..... N75-32641 #
EPA-670/2-75-062 ..... N75-32643 #
EPA-670/2-75-063 ..... N75-32642 #
EPA-670/2-75-064 ..... N75-32644 #

EPRF-TR-2-75 (CSC) ..... N75-32781 #
EPRF-TR-3-75 (ESC) ..... N75-32704 #

EPRI-203-1 ..... N75-32602 #
EPRI-259 ..... N75-32633 #

ER74-4272 ..... N75-32342 #
ER75-4349 ..... N75-32278*#

ESD-TR-75-103 ..... N75-32341 #
ESD-TR-75-107 ..... N75-32446 #
ESD-TR-75-167 ..... N75-32287 #

ESL-SR-626 ..... N75-32128*#

ESRO-CR(P)-437 ..... N75-32907 #

ESRO-SP-107 ..... N75-32532 #

ESTEC-1718/72-AA ..... N75-32907 #

FAA-AM-75-3 ..... N75-32750 #

FAA-ED-00-C ..... N75-32083 #

FAA-EM-74-1 ..... N75-32085 #

FAA-RD-74-125-VOL-1 ..... N75-32122 #
FAA-RD-74-125-VOL-2 ..... N75-32123 #
FAA-RD-74-125-VOL-3 ..... N75-32124 #
FAA-RD-75-75 ..... N75-32279 #

FEL-28 ..... N75-32769 #

FFA-AU-932 ..... N75-32417 #

FR-1188-101 ..... N75-32758*#

FSD-TR-75-166 ..... N75-32087 #

FSTC-HT-23-127-74 ..... N75-32930 #
FSTC-HT-23-218-74 ..... N75-32944 #
FSTC-HT-23-472-74 ..... N75-32451 #
FSTC-HT-23-714-74 ..... N75-32226 #
FSTC-HT-23-1422-72 ..... N75-32693 #

FTAS/TR-75-100 ..... N75-32031*#

FTD-HC-23-1704-74 ..... N75-32254 #
FTD-HC-23-2049-74 ..... N75-32393 #
FTD-HC-23-2367-74 ..... N75-32604 #
FTD-HC-23-2853-74 ..... N75-32869 #
FTD-HC-23-2880-74 ..... N75-32466 #

FTD-HT-23-0638-75 ..... N75-32194 #
FTD-HT-23-0793-75 ..... N75-32332 #
FTD-HT-23-1871-74 ..... N75-32197 #
FTD-HT-23-1876-74 ..... N75-32196 #
FTD-HT-23-1877-74 ..... N75-32198 #
FTD-HT-23-1983-74 ..... N75-32250 #
FTD-HT-23-1986-74 ..... N75-32195 #

FTD-HT-24-217-75 ..... N75-32039 #
FTD-HT-24-260-75 ..... N75-32419 #
FTD-HT-24-261-75 ..... N75-32394 #
FTD-HT-24-268-75 ..... N75-32412 #
FTD-HT-24-272-75 ..... N75-32110 #
FTD-HT-24-276-75 ..... N75-32400 #
FTD-HT-24-308-75 ..... N75-32889 #
FTD-HT-24-440-75 ..... N75-32041 #
FTD-HT-24-992-74 ..... N75-32743 #
FTD-HT-24-0195-75 ..... N75-32252 #
FTD-HT-24-0250-75 ..... N75-32801 #
FTD-HT-24-0303-75 ..... N75-32410 #
FTD-HT-24-0326-75 ..... N75-32401 #
FTD-HT-24-0461-75 ..... N75-32413 #
FTD-HT-24-0467-75 ..... N75-32109 #
FTD-HT-24-0482-75 ..... N75-32414 #
FTD-HT-24-0493-75 ..... N75-32411 #
FTD-HT-24-0578-75 ..... N75-32040 #
FTD-HT-24-1498-74 ..... N75-32897 #

FTD-HT-24-1501-74 ..... N75-32392 #
FTD-HT-24-1766-74 ..... N75-32236 #
FTD-HT-24-1772-74 ..... N75-32172 #
FTD-HT-24-1997-74 ..... N75-32415 #
FTD-HT-24-2015-74 ..... N75-32200 #
FTD-HT-24-2248-74 ..... N75-32416 #
FTD-HT-24-2385-74 ..... N75-32674 #
FTD-HT-24-2770-74 ..... N75-32184 #
FTD-HT-24-2814-74 ..... N75-32255 #
FTD-HT-24-2892-74 ..... N75-32249 #

G/J-TR-66.116-74.01 ..... N75-32284 #

GARP-SPEC-REPT-14 ..... N75-32687 #

GER-16146-VOL-1 ..... N75-32032*#
GER-16146-VOL-2 ..... N75-32033*#
GER-16146-VOL-3 ..... N75-32034*#
GER-16146-VOL-4 ..... N75-32035*#

GE74TMP-33-REV ..... N75-32300 #

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